MECHANICAL ENGINEERING

• AUGUST 1952 •

The Pattern of Gas-Turbine Development . . . . F. T. Hague 627

What Standardization Means to the Mechanical Industries . . . . . W. R. McCaffrey 633

Engineering Uses of Analog Computing Machines . . . . . C. B. Crumb, Jr. 635

The ASME Boiler Code
II—ASME Sets Up Boiler Code Committee and Adopts Code of 1914 . . . . . A. M. Greene, Jr. 640

A Suggested Filing System . . . . G. A. Hawkins and L. M. K. Boelter 647

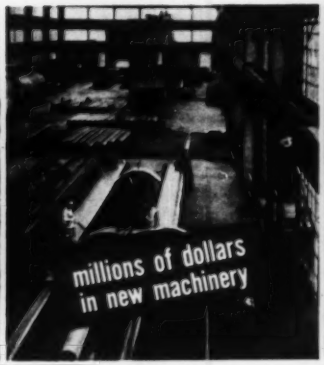
Let's Take the Strait Jacket Off Technical Style . . . . . R. L. Shurter 649

Price Controls in Mobilization . . . . . E. C. Brown 651

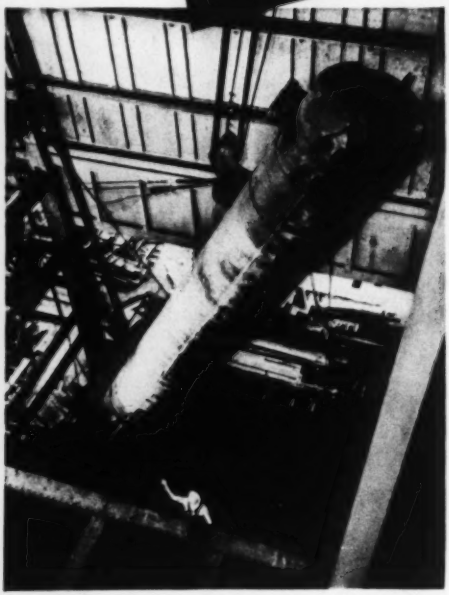
Departments

Briefing the Record, 653
ASME Technical Digest, 665
ASME News, 676
Keep Informed, Adv. Page 41

ASME FALL MEETING—Chicago, Illinois, September 8-11, 1952



B&W EXPANDS FOR MORE STEAM POWER FOR AMERICA



Many new B&W boilers are being installed all over America to supply greatly increased steam requirements of industries and electric power stations. Pictured is a main steam drum being hoisted into place.

Keeping pace with the nation's continuing industrial expansion, The Babcock & Wilcox Company is completing this year a multi-million-dollar increase in facilities for the manufacture of boilers for electric generating stations, industrial plants, institutions, public buildings and apartment houses, chemical plants, oil refineries, and merchant and naval vessels.

Two new plants are already in production at Wilmington, N. C. and West Point, Miss. A third one is being built at Paris, Texas. Thousands of additional employees have been trained to man these new plants, and to work expanded fabricating facilities at five other B&W plants. New machines and processes . . . including the world's largest boiler plate press . . . are setting new standards of production efficiency and speed.

America's dynamic urge to accomplish finds expression in industry's phenomenal, growing capacity to mass-produce; Babcock & Wilcox is sharing in that growth to meet mounting steam requirements for power generation, production processes and heating.

BABCOCK & WILCOX

N-143

The bare facts about *Ball Bearings*

1 Nothing Rolls Like a Ball. It is nature's favorite, strongest form. Having no ends, it rolls freely in any direction.

2 Its inherent resistance to load is greatly increased by curved raceways which, under load, are partly filled by an arc of the ball. "Point contact" talk is the bunk. Actually, its contact is an ellipse, like this:

3 This is how a ball resists thrust (axial loads) as well as radial loads—like a bicycle on a banked track.

4 Put two rows of balls together, and you can support thrust and radial loads from any direction. They may be in one single bearing or in two separate bearings.

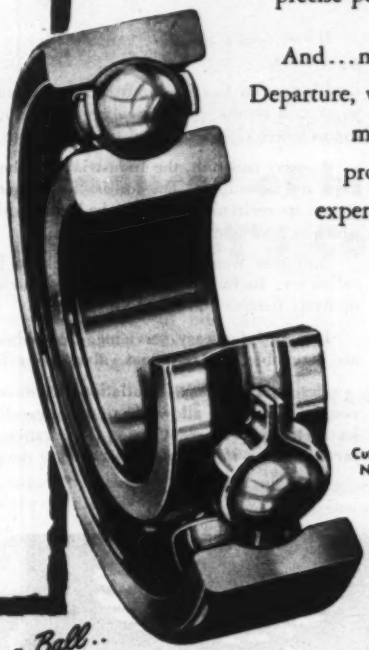
5 Unlike other types of rolling elements, the ball need not be forced to travel in the proper direction. Function of separator is merely to keep balls spaced. Contact is in region of poles (point of slowest rotation—least friction.)

6 Only ball bearings may be self-sealed with integral closures of felt and metal. In average conditions New Departures are lubricated for life. Other type bearings cannot maintain precise "interfitment" needed to maintain efficient self-sealing.

Rugged New Departure Ball Bearings lick friction with free-rolling, tough, forged steel balls.

They welcome today's more exacting requirements of higher speeds, heavier loads and *continued* precise positioning of moving parts.

And...most important of all, New Departure, world's largest ball bearing maker, meets your particular problems with a vast fund of experience and *original thinking.*



Cut-away view of New Departure Ball Bearing

Nothing Rolls Like a Ball..

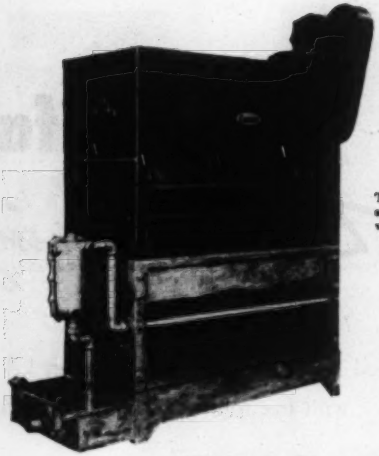
NEW DEPARTURE

BALL BEARINGS

179

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONNECTICUT

MECHANICAL ENGINEERING, August, 1952, Vol. 74, No. 8. Published monthly by The American Society of Mechanical Engineers, at 20th and Northampton Sts., Easton, Pa. Editorial and Advertising departments, 29 West 39th St., New York 18, N. Y. Price to members and affiliates one year $3.50, single copy 50¢; to nonmembers one year $7.00, single copy 75¢. Postage to Canada, 75¢ additional, to foreign countries $1.50 additional. Entered as second-class matter December 21, 1920, at the Post Office at Easton, Pa., under the Act of March 3, 1879. Member of the Audit Bureau of Circulations.



The Carrier Industrial Weathermaker. Available in five sizes, this unit is matched in size and performance to work with a full line of Carrier refrigerating equipment.

Who needs air conditioning with year-round humidity control?

If you need a unit for year-round temperature-humidity jobs, here's good news.

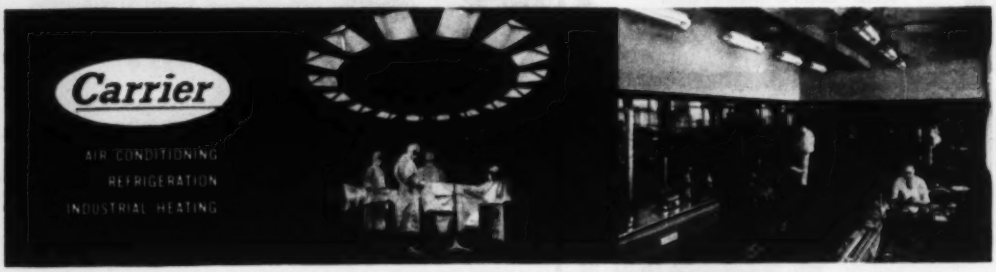
It's the new Carrier Industrial Weathermaker – ideal for textile and paper test rooms, pharmaceutical laboratories and hospital operating rooms where close control of temperature *and* humidity is required.

A spray coil unit, the Industrial Weathermaker cools, dehumidifies, heats and humidifies. The coil is direct expansion or chilled water. The sprays are recirculated and can be heated with a steam spraywater heater, which is a standard component.

And this Weathermaker was built to be installed where quiet is called for. Its fan section is thermally and acoustically insulated, and is perfectly balanced to avoid vibration.

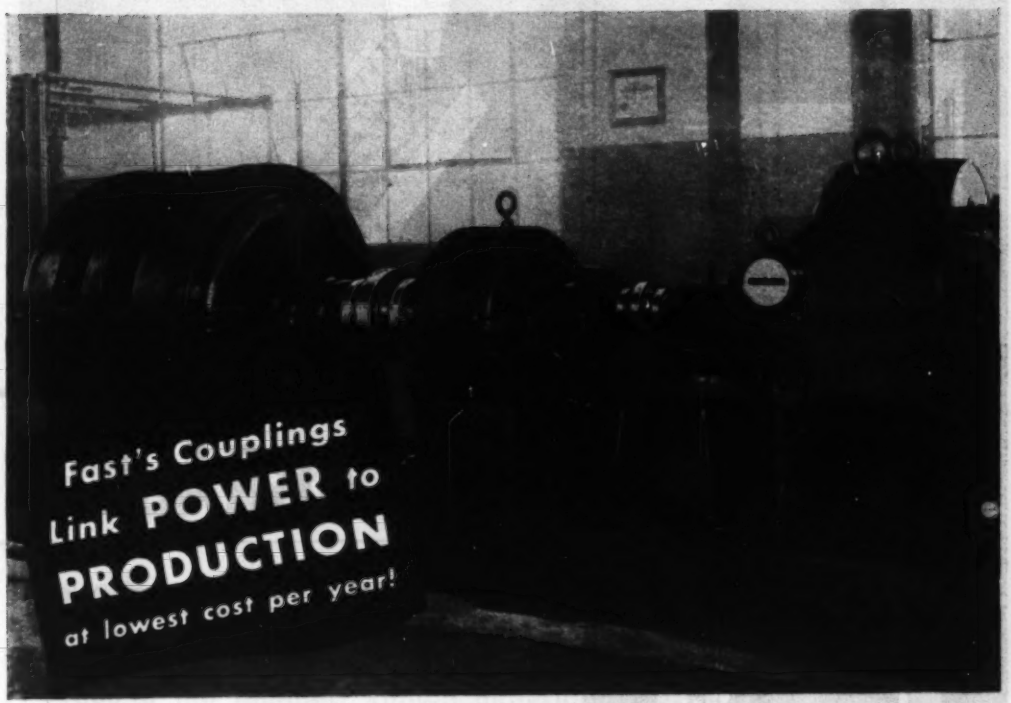
Designed for easy servicing, the Industrial Weathermaker's parts are accessible . . . like float valves being located in the sump section.

Designed for easy installation, its standard arrangement will save you field work and allow you to do an excellent low-cost job. Write and let us tell you more. Carrier Corporation, Syracuse, New York . . . *for 50 years – the people who know air conditioning best.*



To reduce danger of explosions from static sparks, hospital operating rooms require the close humidity control offered by the Carrier spray-type Weathermaker.

Testing laboratories, too, need accurate temperature-humidity control. The Industrial Weathermaker is available in five sizes, from 4100 to 16,400 cfm.



Every major producer of high-speed equipment uses FAST'S Couplings!

HIGH-SPEED equipment demands components with superior strength, accurate manufacture, long-lasting dependability. That's why it's important to *you* that Fast's Couplings are selected by every major high-speed equipment producer!

Fast's usually outlast the equipment they connect. Many have been in continuous operation for over 30 years, without trouble of any kind. And Fast's longer life saves you coupling dollars, too, because you amortize their cost over many years of trouble-free operation.

For full details on Fast's Couplings and Koppers Engineering Service, write today for your free copy of our catalog. Send to: KOPPERS COMPANY, INC., *Fast's Coupling Dept.*, 258 Scott St., Baltimore 3, Maryland.

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Gentlemen: Send me Fast's Catalog which gives detailed descriptions, engineering drawings, capacity tables and photographs.

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Company .....

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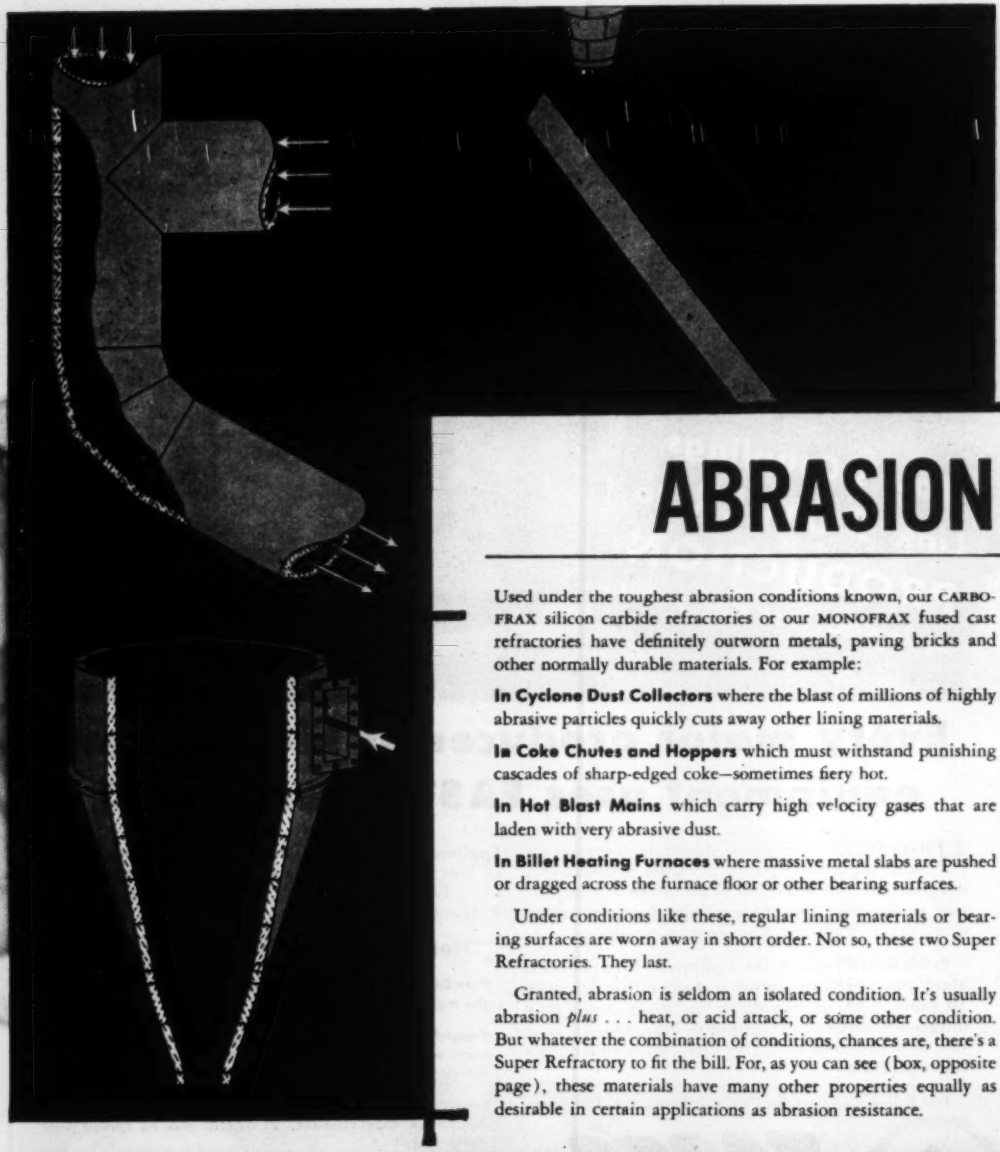

ABRASION

Used under the toughest abrasion conditions known, our CARBOFRAX silicon carbide refractories or our MONOFRAX fused cast refractories have definitely outworn metals, paving bricks and other normally durable materials. For example:

In Cyclone Dust Collectors where the blast of millions of highly abrasive particles quickly cuts away other lining materials.

In Coke Chutes and Hoppers which must withstand punishing cascades of sharp-edged coke—sometimes fiery hot.

In Hot Blast Mains which carry high velocity gases that are laden with very abrasive dust.

In Billet Heating Furnaces where massive metal slabs are pushed or dragged across the furnace floor or other bearing surfaces.

Under conditions like these, regular lining materials or bearing surfaces are worn away in short order. Not so, these two Super Refractories. They last.

Granted, abrasion is seldom an isolated condition. It's usually abrasion *plus* . . . heat, or acid attack, or some other condition. But whatever the combination of conditions, chances are, there's a Super Refractory to fit the bill. For, as you can see (box, opposite page), these materials have many other properties equally as desirable in certain applications as abrasion resistance.

Super Refractories by

CARBORUNDUM

Refractories Division — Perth Amboy, N. J.

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SUPER REFRACTORIES ARE ALSO USED

WHERE HEAT CONDUCTIVITY IS NEEDED. At elevated temperatures CARBOFRAX refractories conduct heat *almost as rapidly as chrome-nickel steels!* This characteristic is invaluable in checkers, muffles, hearths, radiant heating tubes, etc. It often radically increases the capacity of the equipment. There are also Super Refractories which are very good insulators, particularly at high heats.

WHERE CHEMICAL ACTION IS PRESENT. In general, all Super Refractories are either neutral or acid in nature. They are widely used where chemical inertness is important.

WHERE STRENGTH IS IMPORTANT. No commercial tonnage refractories have greater strength than Super Refractories. All can withstand over 300 psi at 2750° F without crushing. The modulus of rupture of one composition averages 3100 psi at 2460° F.

WHERE HIGH HEAT IS INVOLVED. They can be safely used at temperatures over 3000° F. They are very durable—are highly resistant to spalling and cracking. Some varieties are almost indispensable where flame impingement or violent temperature changes are present.

that will cut through metal

hardly touches these materials

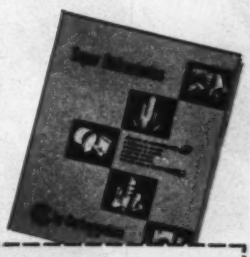
They're the toughest known materials for large scale commercial use—so tough, they'll quickly wear out the best grinding wheels.

Have you any spots in your equipment that are vulnerable to abrasion? Areas that need constant relining or replacing? Then don't fail to investigate our CARBOFRAX bricks and shapes, and our MONOFRAX K blocks. Both materials give "armor-plated" protection. Both are extremely hard—within one index point of diamond hardness!

Possessing properties seldom associated with refractories, these, and other Super Refractories by CARBORUNDUM, are often used *regardless of whether high temperatures are involved.* Great strength and durability plus high resistance to heat, corrosion and abrasion, make them ideal for a wide range of applications.

It's surprising how often you'll find places in your equipment where Super Refractories are inherently better—and less expensive—than other materials. They're well worth investigating, particularly in this period of scarce critical materials.

Why not check up? Practically all Super Refractories are available as bricks or special shapes molded to close tolerances—including fitted joints, tubes, etc. Send today for our booklet describing the properties of these unique materials.



Information is now available on all the various groups of Super Refractories by CARBORUNDUM. Just send the coupon for our new booklet. No obligations, of course.

Dept. P-82
Refractories Div., The Carborundum Co.
Perth Amboy, New Jersey

Please send your free booklet describing the principal properties of Super Refractories.

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Position_____

Company_____

Street_____

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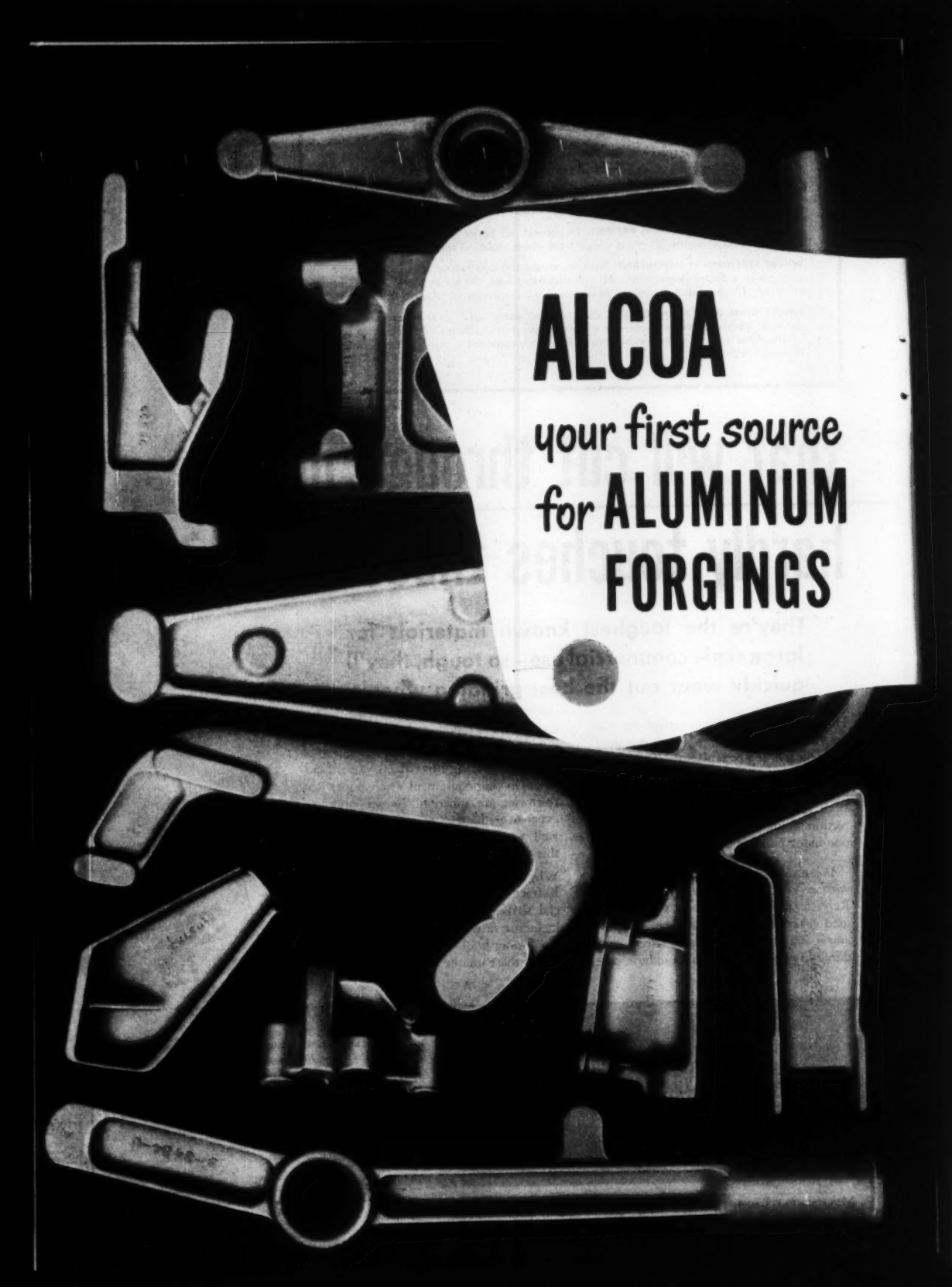
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FORGINGS

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- **30 years in the forging business, 64 years of aluminum experience.**
- **Design and development assistance backed by the world's greatest aluminum research laboratories.**
- **Forging plants located in the midwest and on the west coast.**

One of a battery of Alcoa's mechanical forging presses. These presses and the necessary heating and inspection equipment are arranged for high production in Alcoa plants.

All Alcoa forgings undergo thorough inspection before shipment. The most modern equipment and methods are available to Alcoa plants for performing physical testing, metallographic and ultrasonic examination.

Hand forgings of extremely large size are produced by Alcoa's presses and hammers. Alcoa has such large equipment in both forge shops.

Alcoa forge shops are equipped with the latest heat-treatment facilities. Here, time, temperature and quenching cycles are closely controlled to produce the highest quality forging.

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While the sale of our products is presently controlled by government regulation, you'll find no limitations on help in design, application or fabrication. Your local ALCOA sales office is headquarters for "everything" in aluminum. Alcoa sales engineers will co-operate to the fullest in helping you get the metal you need. Look for Alcoa under "Aluminum" in your classified phone book.

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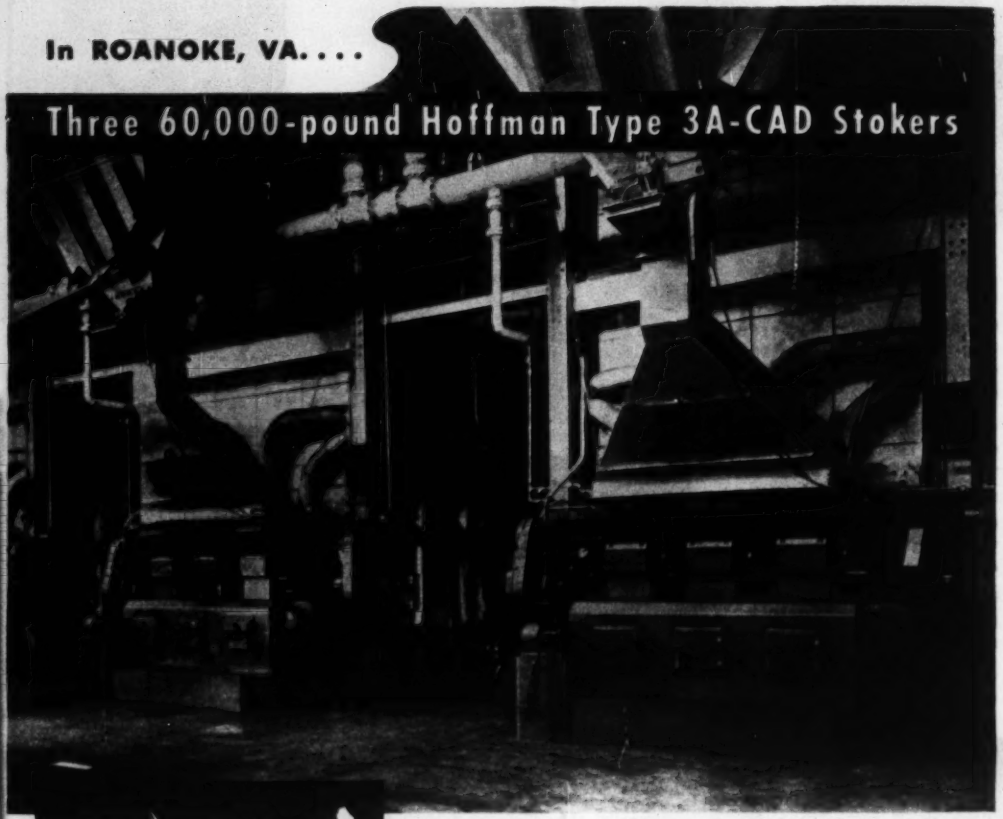
ALCOA *first in* ALUMINUM

ALUMINUM COMPANY OF AMERICA

In ROANOKE, VA. . . .

Three 60,000-pound Hoffman Type 3A-CAD Stokers



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Chicago, Ill.	Philadelphia, Pa.
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Three Hoffman 60,000-pound Continuous Ash Discharge stokers in this Roanoke plant burn any Bituminous coal contiguous to the local market. The stokers are proportioned so that two boilers will carry the normal plant load of 180,000 pounds of steam in an emergency.

Get the dramatic story of how a small group of Hoffman Engineers pioneered the forced draft spreader stoker into a dominant position in a world market . . . for unit steam capacities of 25,000 to 250,000 pounds per hour.

There is a HOFFMAN ENGINEER in your vicinity—Also Hoffman Stoker users. Investigate!

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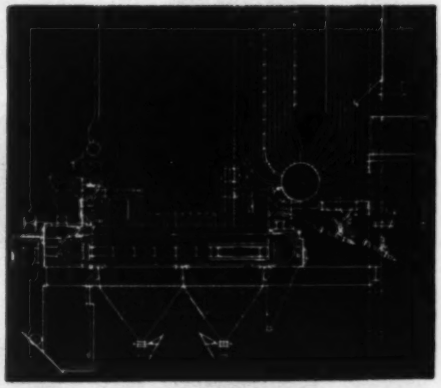
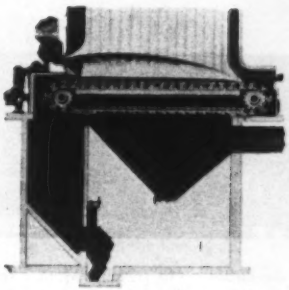
Puget Sound Machinery Co.
Riley Stoker Company
Springfield Boiler Company
Union Iron Works Company
Henry Vogt Boiler Company
Wickes Boiler Company



TYPICAL USERS of HOFFMAN C·A·D STOKERS

Army Air Base
Chemical Industries
Brewing Industry
Coal Mining
Drop Forging
Educational
Federal Power Utilities
Great Lakes Shipping
Harvesting Machinery Mfg.
Municipal Plants
Metal Working Plants

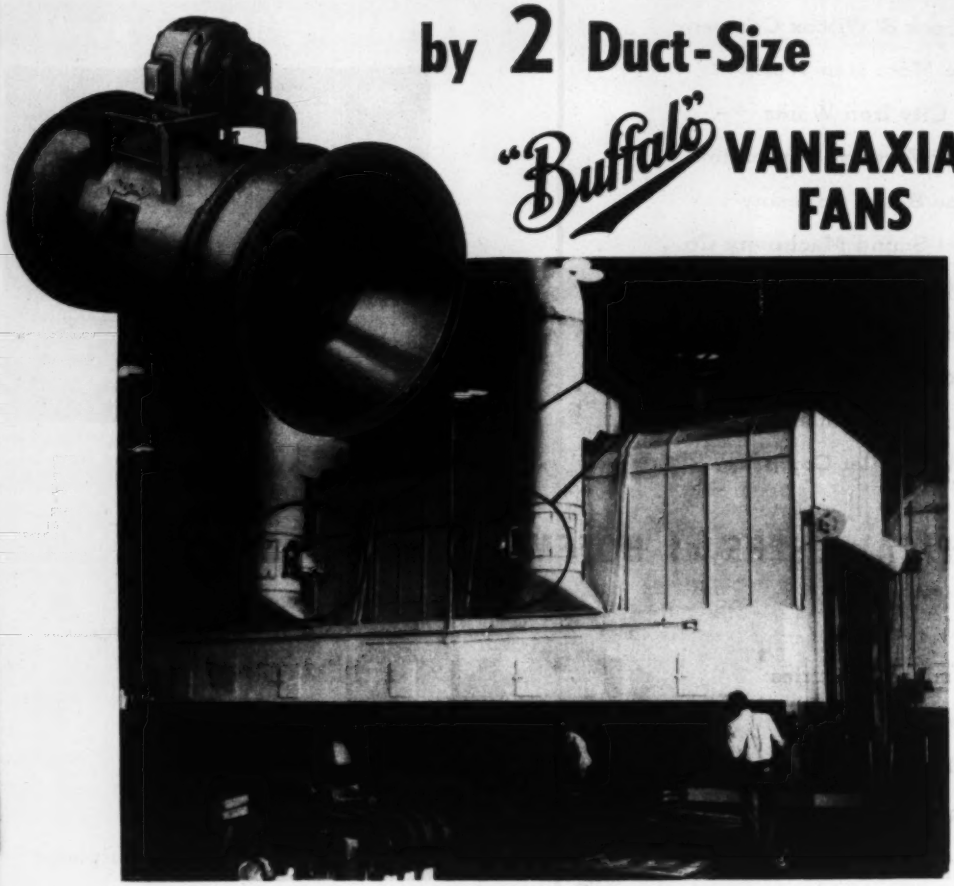


Materials Drying Plants
Plate Glass
Public Utilities
Paper Mills
Pharmaceutical Mfg.
Printing & Office Equipment
Portland Cement Mfg.
Paint Materials Processing
Rubber Industry
Railroad Shops
Textile Machinery Mfg.

General Offices: Marquette Building, Detroit 26, Michigan

Works: Fairmont, W. Va. and Detroit, Michigan

Thorough Paint Spray Exhaust by 2 Duct-Size "Buffalo" VANEAXIAL FANS



This Mahon Hydro-Filter Spray Booth in the Euclid Road Machinery Company's Cleveland plant accomodates large units of road building machinery and special vehicles. And two duct-size "Buffalo" Vaneaxial Fans do the exhaust job efficiently, quietly and with little attention. Fitting in like a piece of duct, these fans waste no space and are economical to install. Motors in these models are mounted outside, away from the air stream. Inspection and servicing are made easy by access doors fastened by refrigeration type latches.

There is a "Buffalo" Fan ready to solve *your* problem. Why not write today for details?

75

"Buffalo" FIRST FOR FANS

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Another 'open and closed' case for

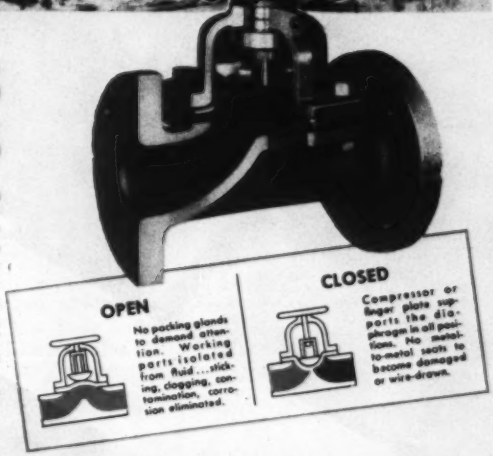
GRINNELL-SAUNDERS DIAPHRAGM VALVES

In 1936, a Canadian mine installed Saunders Diaphragm Valves with rubber linings on the feed and drain piping of an underground tank used for the storage of muriatic acid. Today, after 15 years, those *same* valves are in use—having required no maintenance except for periodic replacement of diaphragms, a simple operation done without removing the valve from the line.

Grinnell-Saunders Diaphragm Valves are available in many different combinations. Bodies are made in a variety of metals —iron, stainless steel, bronze, aluminum and others. *But of more importance* is the fact that a body of cast iron (a metal not in short supply) can be lined with glass, lead, natural rubber, neoprene and other materials which, in many instances, handle corrosive fluids *better* than metals.

Diaphragms come in natural rubber, neoprene, butyl, hycar, a special synthetic for foods and KEL-F. This last is chemically inert to all acids and alkalies in all concentrations with the exception of molten alkali metals.

From this broad selection of materials, the problems which the Grinnell-Saunders valve can solve are extremely varied. No wonder industry after industry is putting it on the line.

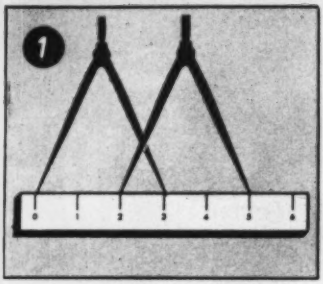

OPEN
No packing glands to demand attention. Working parts isolated from fluid...sticking, clogging, contamination, corrosion eliminated.
CLOSED
Compressor or finger plate supports the diaphragm in all positions. No metal-to-metal seats to become damaged or wire-drawn.

GRINNELL

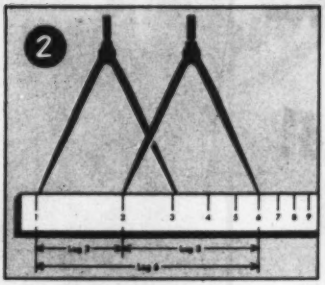
WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

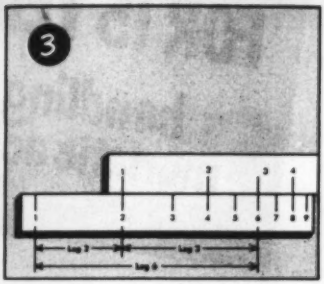
pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems



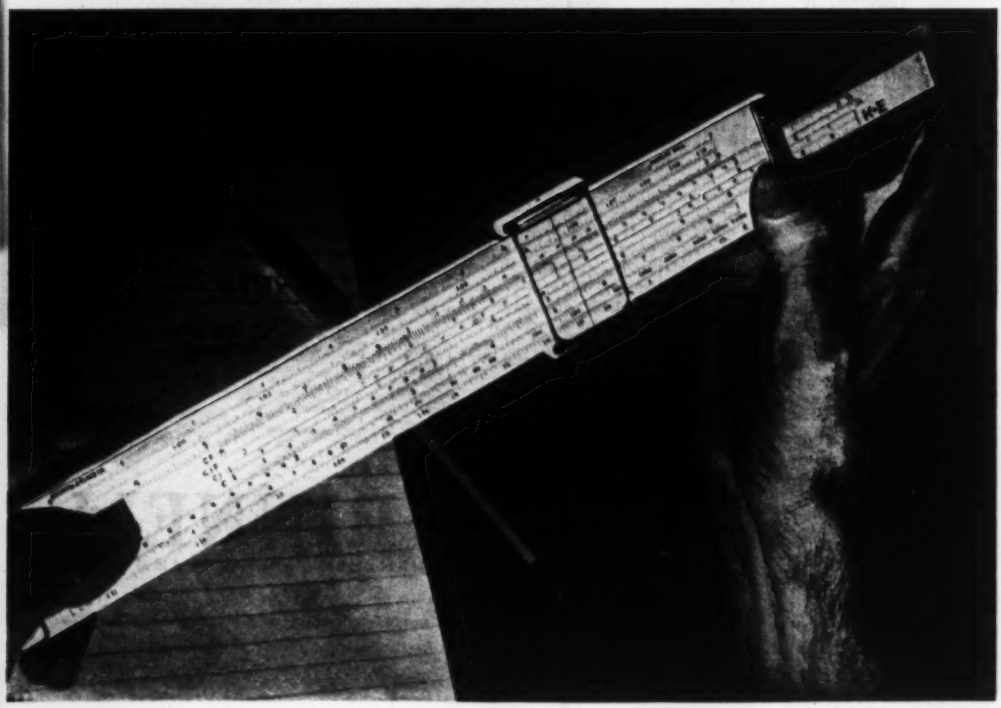
In a mechanical sense, the slide rule merely adds and subtracts quantities. How these simple operations can be performed mechanically may be seen from the illustration above, which shows the addition of 2 and 3 by means of a pair of dividers applied to an ordinary 6-inch rule. Even many electronic calculators work basically on this principle.

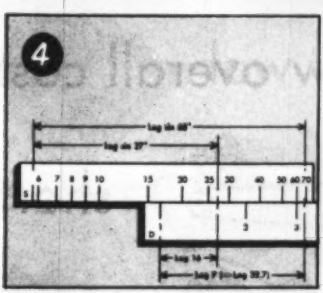


With a different system of calibrations on the scale, if appropriate meanings are assigned to them, more difficult problems may be solved in the same way. An example of this is seen above where a pair of dividers is shown adding 2 and 3 on a logarithmic scale and obtaining the answer 6. Advantage is taken of the fact that the multiplication of numbers may be accomplished by the addition of their logarithms.

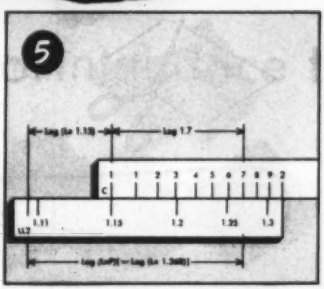


A handier method, which begins to approach the usefulness of a slide rule, is to place two similar logarithmic scales together. Seen above is the simple setting in which 2 is shown being multiplied by 3. Observing the illustration it can be seen that the same setting also multiplies 2 by 2 and 4. Without changing the setting, the device shows the corresponding operations in division.





Problems in plane trigonometry require only appropriate logarithmic scales, calibrated to read in degrees so that operations can be performed on the functions of angles. Two scales of this kind are generally used: one for the sines of angles and the other for tangents. Above is seen a setting for finding $P = \frac{16 \text{ Sin } 68^\circ}{\text{Sin } 27^\circ}$.



Problems of greater complexity, involving higher powers and roots of numbers, including fractional and negative powers and roots, can also be made as easy as 2 + 3 by means of appropriate logarithmic scales. Known as log log scales, they are calibrated to read in logarithms of logarithms. Above is seen a setting for finding $P = 1.15^{1.7}$.

The slide rule has been called the symbol of the engineer. The symbol that distinguishes the slide rule itself for leadership in design and workmanship is the K&E trade mark or the name KEUFFEL & ESSER CO.

Pioneers in the manufacture of slide rules in America, K&E have always been in the forefront with new ideas and improvements. The most recent example is the slide rule of today, the K&E Log Log Duplex Decitrig*, designed on the fundamental and simple principle of referring all its scales to the basic C-D scales. This enables problems involving arithmetic, trigonometric and exponential functions to be readily solved without reading any but the final answer.

Ask your K&E Distributor or Branch for full information about K&E Slide Rules.

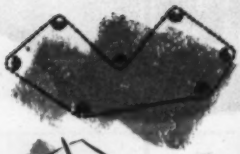
The Right Angle

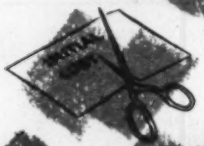
If you'd like l-o-n-g mileage without re-sharpening, get a PARAGON* RED TIP ruling pen. They are tipped with tungsten carbide alloy butt-welded to stainless steel blades. Ideal for use on aluminum, glass cloth and other abrasive surfaces as well as on regular paper or cloth. Identify it by the red tip at the end of the handle.

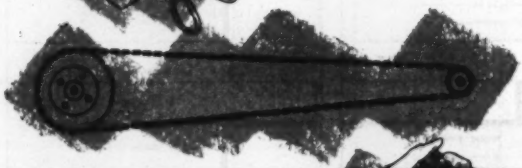
A good way to make life easier is to give your drawing board a glass-smooth, non-glare working surface with a covering of LAMINENE†. This drawing board backing material is washable, hard enough to minimize pencil scoring, but yielding enough for pencil lines to take well. Comes either white or green, in rolls.

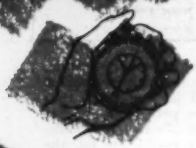
*Trade Mark ®
†Trade Mark

If Your Design Problem

design flexibility  dependability

low initial cost  low overall cost

long centers  short

positive timing  heat

ease of installation long life

Chain Is Your Answer

Yes, chain will solve any of these problems in both drive and conveyor service. The important point is to be sure you select the best chain to do the job. That's why so many designers make their selections from the complete Chain Belt line.

In the complete Chain Belt line there are literally hundreds of sizes and types of chain . . . but only one can be the *best* chain for your particular application. For example: for a high speed drive, Baldwin-Rex® Roller Chain is probably most efficient. For conveying cans, bottles, and jars

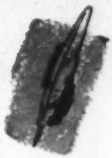
REX

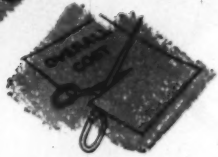
BALDWIN-REX

Chain

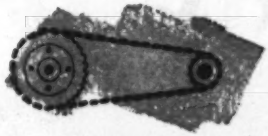
ATLANTA • BIRMINGHAM • BOSTON • BUFFALO
CHICAGO • CINCINNATI • CLEVELAND • DALLAS
DENVER • DETROIT • EL PASO • HOUSTON
INDIANAPOLIS • JACKSONVILLE • KANSAS CITY
LOS ANGELES • LOUISVILLE

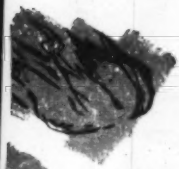
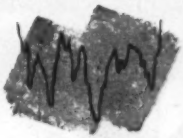
Involves...

saving weight

saving space



low maintenance cost

centers

constant speed ratios


cold

fixed centers

resistance to dirt, grease, grit

you choose between Rex TableTop® and Baldwin-Rex PlateTop, depending on load conditions; where loads are heavy and chain must operate in dust and dirt, some type of Rex Chabelco® is usually indicated.

Our Rex Field Sales Engineers are specially trained to help you with your chain selection problems. For more help, call your nearest Chain Belt branch office or write to Chain Belt Company, 4765 W. Greenfield Ave., Milwaukee 1, Wisconsin.

Belt COMPANY
OF MILWAUKEE

MIDLAND, TEXAS • MILWAUKEE • MINNEAPOLIS
NEW YORK • PHILADELPHIA • PITTSBURGH
PORTLAND, OREGON • SPRINGFIELD, MASS.
ST. LOUIS • SALT LAKE CITY • SAN FRANCISCO
SEATTLE • TULSA • WORCESTER

Chain Belt Company 52-101
4765 W. Greenfield Ave.
Milwaukee 1, Wis.
Gentlemen:
My chain selection problem is.....
.....
Please send me appropriate literature.
Name.....
Company.....*Dept.*.....
Address.....
City.....*State*.....

...*when you LEAD them*, that's game in the BAG

You have to shoot *ahead* of fast-moving game, if you want to take home something for dinner. Same with business. Now's the time to plan for the day when you can get all the materials you want, with allocations gone, orders maybe not so plentiful, and competition red-hot. ● Allegheny Stainless Steel can work marvels in adding sales advantages to the products you make, or reducing operating costs in the equipment you use. Let our Development Engineers show you how.

Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.

AL
TIME-TESTED
STAINLESS STEEL

You can make it *BETTER* with

Allegheny Metal

W&D 4098 ●

LADISH

Controlled Quality

PIPE FITTINGS

maximum service assured by metallurgical soundness

Sound metallurgy . . . the result of unsurpassed facilities and advanced laboratory controls . . . provides the maximum of dependability in Ladish Controlled Quality fittings. Every phase of metal quality . . . composition, structure and physical properties . . . is continuously safeguarded — and certified proof of metallurgical integrity is available to users of Ladish fittings.

TO MARK PROGRESS

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
St. Louis • Atlanta • Houston • Tulsa • Los Angeles • Havana • Toronto • Mexico City

American Blower...a time-honored name in air handling

Dayton, Ohio, has a conveniently located American Blower Office to provide you with data and equipment for air handling. You can reach American Blower in Dayton by calling Hemlock 2689. In other cities, consult your phone book.

BETTER PROCESSING

Fluorine, the remarkable chemical that helps retard tooth decay, is currently in great demand. American Blower has worked with several manufacturers in developing efficient fume removal methods. Our Type E Fans, for example, are highly effective in the removal of odors, corrosive fumes and gases. Often, our standard Type E Fans, without special or extra features, can be readily applied to systems or processes with elevated temperatures at a sizable saving in costs. If you have a fume removal problem, call our nearest branch office.

SUCCESS STORY

Combine ingenuity and dependable, precision-built equipment and you have all the ingredients of a business success story. In this case, a glass-container manufacturer had the problem of cooling molten glass from white-hot to crystal-clear during the molding process. The solution: A battery of American Blower fans, strategically located, forced cool air at high velocity over the automatic molding machine. The result: more glass containers per hour, lower costs per container, a neat price advantage at the sales level.

NICER WASHROOMS

Why not include better washroom ventilation in your plant modernization program? It's a low cost "plus" that employees appreciate. American Blower makes a complete line of fans and blowers for this job, including Utility Sets for duct systems and Ventura Exhaust Fans. Chances are, the types you require are stocked locally for prompt delivery.

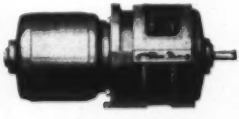
YOUR BUSINESS

No matter what your needs – heating, cooling, drying, air conditioning or air handling – you'll find American Blower an excellent source of supply. For data, phone our nearest branch office.

Unit Heaters

Mechanical Draft Fans

Air Conditioning Equipment



Gyrol Fluid Drives

Utility Sets

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

YOUR BEST BUY **AMERICAN BLOWER** AIR HANDLING EQUIPMENT

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • THERMIONIC IRON

when you want a direct answer

. . . to your direct current motor problems, look to your nearby Fairbanks-Morse Electric Motor Specialist.

He is technically qualified to help you select the equipment exactly suited to your D.C. needs.

Whether you are interested in a D.C. or A.C. motor . . . one or a thousand—one type and size, or a variety of types and sizes . . . you'll find that motors carrying the Fairbanks-Morse Seal are designed and built to your most rigid requirements.

When you look for electric motors—for standard or unusual applications—*always* look for the Fairbanks-Morse Seal. For over 120 years it has stood for the finest in manufacturing integrity to *all* industry. Fairbanks, Morse & Co., Chicago 5, Illinois.

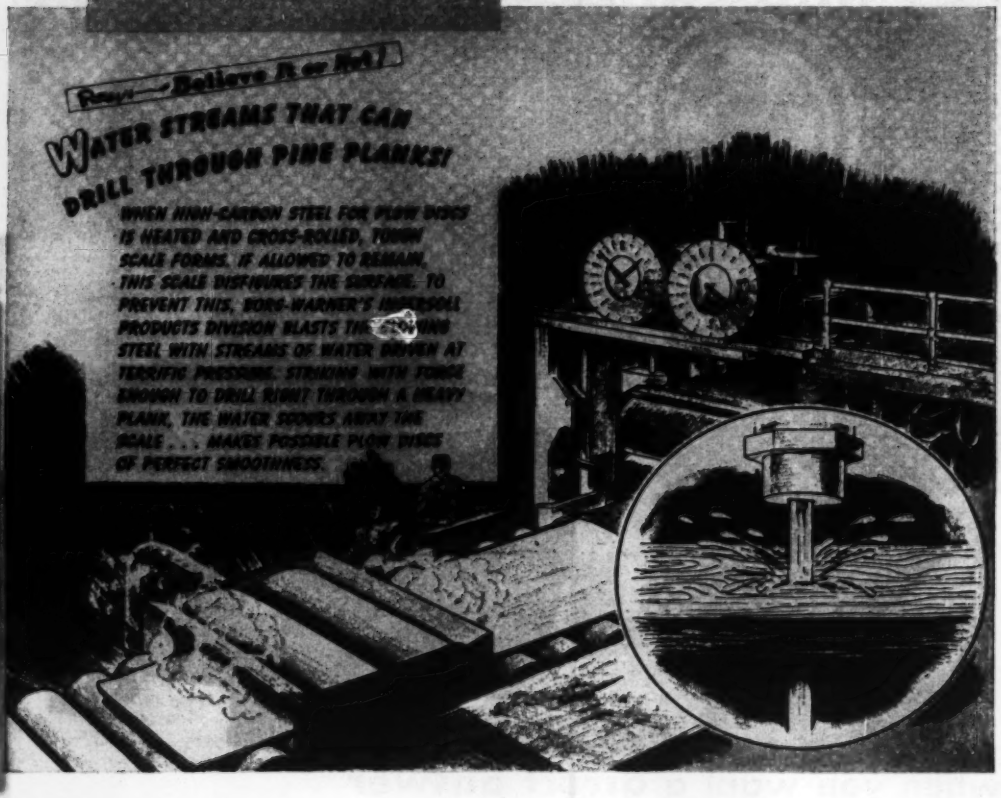
FAIRBANKS-MORSE

a name worth remembering when you want the best

DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY • PUMPS • SCALES
HOME WATER SERVICE EQUIPMENT • RAIL CARS • FARM MACHINERY • MAGNETOS

DE LAVAL
descaling spray pumps

deliver the punch


Now—Believe It or Not!
WATER STREAMS THAT CAN DRILL THROUGH PINE PLANKS!
WHEN HIGH-CARBON STEEL FOR PLOW DISCS IS HEATED AND CROSS-ROLLED, TOUGH SCALE FORMS. IF ALLOWED TO REMAIN, THIS SCALE DISFIGURES THE SURFACE. TO PREVENT THIS, BORG-WARNER'S INGERSOLL PRODUCTS DIVISION BLASTS THE [illegible] STEEL WITH STREAMS OF WATER DRIVEN AT TERRIFIC PRESSURE. STRIKING WITH FORCE ENOUGH TO DRILL RIGHT THROUGH A HEAVY PLANK, THE WATER SCOURS AWAY THE SCALE . . . MAKES POSSIBLE PLOW DISCS OF PERFECT SMOOTHNESS.

The pump that delivers the punch is one of the new De Laval Oppeller pumps.

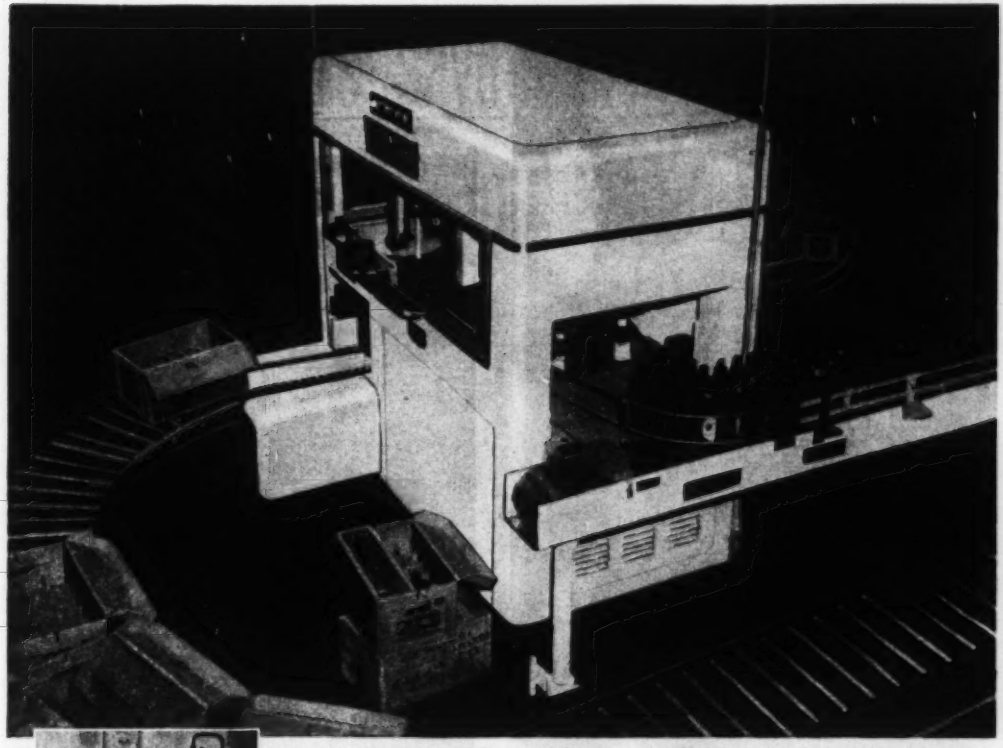
De Laval builds a complete line of multistage opposed impeller pumps for this service. Sizes range from two to eight stages for pressures to 1,200 psi, capacities to 1,000 gpm and temperatures to 350F. Impellers are mounted to provide leak-proof shaft sealing between stages. The shaft is exposed to insure freedom from distortion. Stuffing boxes are removable. Positive interstage wearing rings eliminate leakage.

For a host of steel plant jobs, it pays to decide on *quality-designed* De Laval equipment. Look into the advantages of De Laval blast furnace blowers, coke oven boosters and exhausters, general service and process pumps, mechanical drive turbines and worm gear speed reducers. Consult your De Laval Field Engineer.

DE LAVAL *Oppeller Pumps*

DE LAVAL STEAM TURBINE COMPANY
Trenton 2, New Jersey

DL 180



CHIKSAN aircraft hydraulic swivel joints employed in this application permit complete flexibility in contraction and extension of otherwise rigid fluid lines.

CHIKSAN joints allow the Ermold unpacker head to travel backward and forward with the hydraulic lines folding and unfolding automatically.

CHIKSAN aircraft swivel joints enable Ermold to make sharp bends in the hydraulic lines as the mechanism moves forward and backward in the unloading operation illustrated above.

CHIKSAN Flexibility, Safety and Economy
END BOTTLENECKS!

When the Ermold Division of The Barry-Wehmiller Machinery Company decided to put out an improved automatic unpacker, it just naturally turned to Chiksan Ball-Bearing Swivel Joints to provide the necessary flexibility and stamina for the electrically-controlled hydraulic system.

This system imparts the motion for precision stopping and starting—for raising and lowering elevating mechanism—for gripping firmly and delicately the most fragile material.

This application is just another example of how industry relies on Chiksan's mastery in the flow of liquid and gas—around seemingly impossible joints and angles—and through unyielding metal. Years of engineering of swivel joints have taught Chiksan how to gain precision, achieve incredibly close tolerances, provide higher resistance to extremes of temperature and pressure. *Whether you're a bottler, a chemical processor—engaged in heavy industry, transportation or the petroleum industry, Chiksan Ball-Bearing Swivel Joints can help do a better job for yourself—for your customers—for less. Chiksan's Department of Development and Research stands ready to put its experience and skill to work for you. Write for Catalog 2A, Dept. 8ME.*

The Flow of Enterprise Relies on **CHIKSAN** *Ball-Bearing Swivel Joints*

CHIKSAN

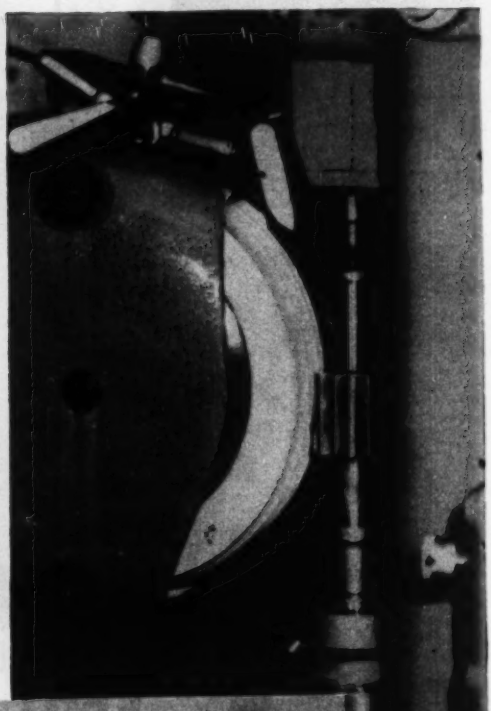
Representatives in Principal Cities

CHIKSAN COMPANY • BREA, CALIFORNIA • Chicago 28, Illinois • Newark 2, New Jersey

Well Equipment Mfg. Corp. (Division), Houston 1, Texas

Chiksan Export Company (Subsidiary), Brea, California • Newark 2, N. J.

"Lean Carilloy



At Commercial Shearing and Stamping Company, gears are machined directly from bar stock. Since the change from rich to lean alloy steel, the need for normalizing and straightening the metal before machining has been eliminated.

Gears are completed on precision grinders like the one shown here.

Three-inch gear blank before teeth are ground; and, on the right, after final machining.

alloy steel is saving us $40 a ton ...with no loss in performance."

—T. C. Kane, Chief Engineer

Commercial Shearing and Stamping Co.

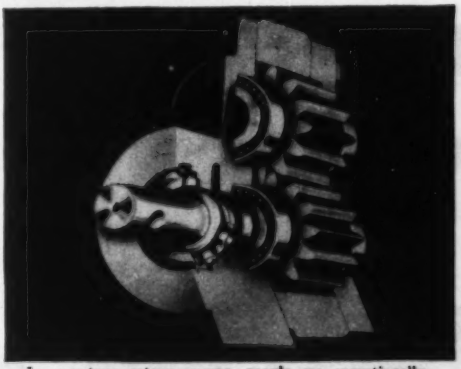
LIKE MANY other manufacturers who, today, cannot get rich alloy steel, Commercial Shearing and Stamping Company of Youngstown, Ohio, has found that many parts that must operate in extremely tough service can be made of *lean* alloy steels with no loss in performance.

Commercial Shearing makes a wide variety of steel products, including stampings and forgings; but it is in their gear-type rotary hydraulic pumps that they must do without rich alloy steel. Choosing a satisfactory alternate steel for the precision gears in these pumps presented quite a problem.

Mr. T. C. Kane, Chief Engineer at Commercial, tells the story this way: "We used to make the gears for our heavy-duty hydraulic pumps out of Carilloy 4615 (a Ni-Mo steel, with 1.65-2.00% nickel). But when nickel started getting scarce, we had to find a steel in better supply that would stand up in this severe service.

"Our gear-type rotary pumps are used in heavy-duty hydraulically-operated mobile equipment and must deliver a constant supply of oil at the correct pressure. In these pumps, oil is trapped between the teeth of two meshing gears and forced through the pump as the gears rotate. To obtain the high efficiencies necessary, gear dimensions must be held within extremely close tolerances. And wear must be held down, because a loss of just 0.005 inch causes a substantial drop in pump efficiency. These pumps operate at pressures as high as 1500 psi and speeds up to 2000 rpm; so we have to be sure to use a tough, wear-resistant steel for the gears. The question was, how to get this in a lean alloy steel.

"One of United States Steel's service metallurgists helped us out. After analyzing our requirements, he suggested a straight-chrome alloy steel—Carilloy 5120. Now that we have lived with this steel for a while, we are frankly surprised at the excellent results we are getting. Not only are our pumps as good as ever, but this straight-chrome steel has important advantages for us over the richer alloy:



In gear-type rotary pumps, speeds are exceptionally high—up to 2000 rpm; and pumps operate at pressures as high as 1500 psi. At Commercial Shearing and Stamping Company, gears for this severe service are now made of straight-chrome instead of nickel-molybdenum steel.

"First of all, Carilloy 5120 is easier to machine, so naturally our tools last longer.

"Our heat treating problems are easier, too. Carilloy 4615 had to be normalized and straightened before machining. This is no longer necessary since there is less distortion in carburizing operation.

"With reduced heat-treating costs and a lower grade extra, the change to lean alloy steel is saving us $40 on each ton of steel we buy."

★ ★ ★

The switch from rich to lean alloys is not always as easy as it was at Commercial Shearing and Stamping Company. You may require special heat treating, or simply more *careful* heat treating, to obtain desired mechanical properties. But whatever your steel problems, our metallurgists will be glad to help you with them. Just call the nearest District Sales Office or write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

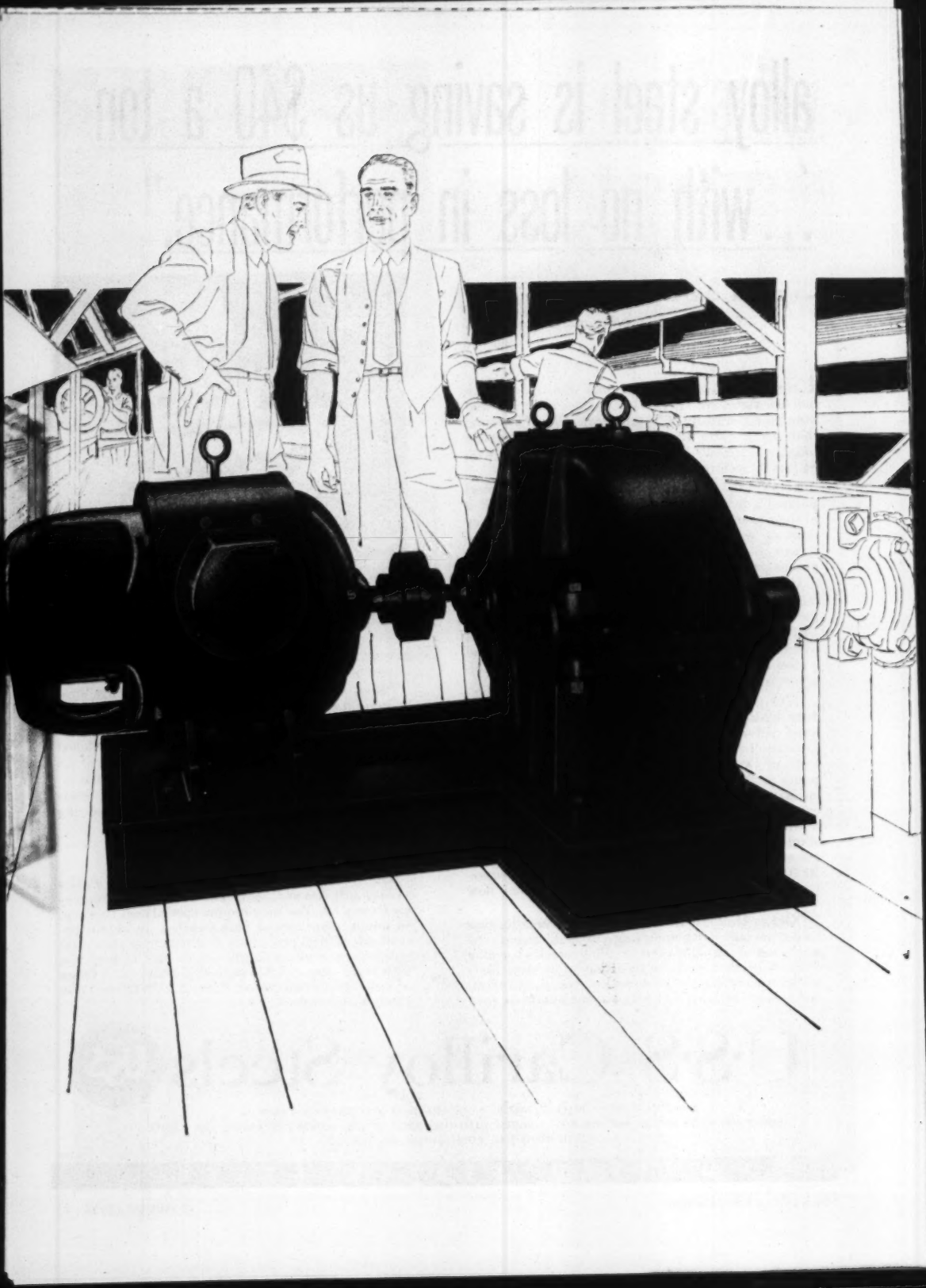
U·S·S Carilloy Steels

USS

UNITED STATES STEEL COMPANY, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

2-1250

UNITED STATES STEEL



"I'll tell you why we buy these Westinghouse Drive Teams"

"We obtain exclusive benefits from the planning stage right on through the long life of the drive. You see, experienced Westinghouse Application Engineers know both mechanical and electrical drive problems. When we put our heads together, we always come up with a better drive solution.

"We also benefit every step of the way from ordering to maintenance because there's only one point of contact required—undivided responsibility. Westinghouse ability and willingness to handle our complete drive requirements sure saves us plenty of headaches. Saves our time and dollars, too.

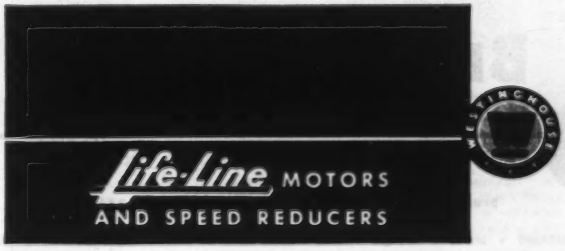
"Experience has shown us that we can depend on a Westinghouse Speed Reducer. The taper-hardened, accurately hobbed gears, the rugged tight case, the efficient roller bearings, the positive lubrication system—all add up to a speed reducer that is second to none.

"The Life-Line d-c motor deserves its share of the credit, too. The features we especially like are the pre-lubricated bearings and the all-steel construction. We install a Life-Line motor and forget it."

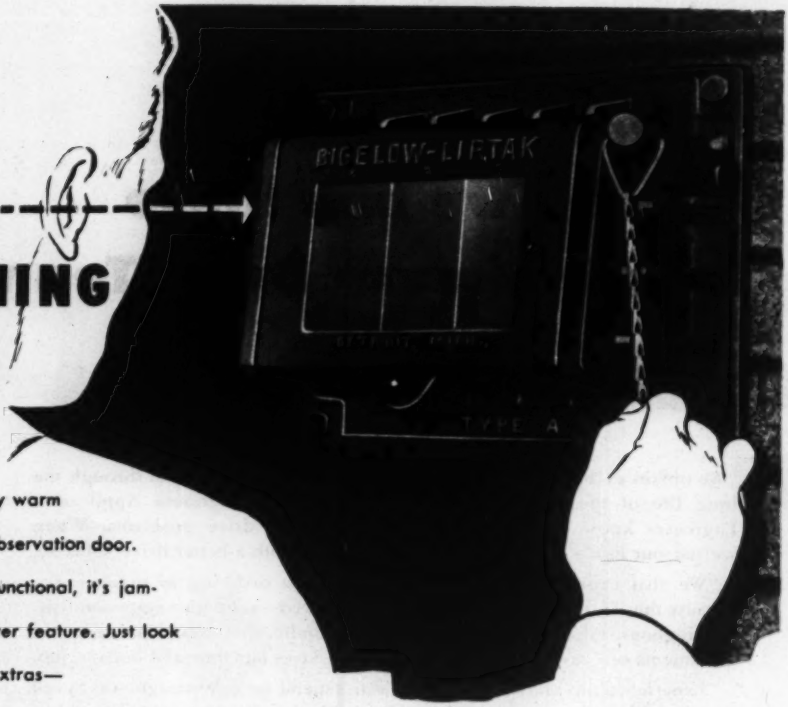
The next time you have a drive problem, call in your Westinghouse representative. Remember—Westinghouse makes the complete drive.

Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

J-07307



WANT TO SEE SOMETHING *Hot?*



Furnace operators easily warm up to Bigelow-Liptak's observation door. Reason: it's husky, it's functional, it's jam-packed with feature after feature. Just look at all these plus-value extras—

- Ample opening—4½" high x 6½" wide.
- Lens frame remains closed by gravity or full open without props.
- Lens is cooled separately to protect glass from radiant heat.
- Blue heat-resisting glass is 7/32" thick—almost double that of usual observation doors.
- Shutter is opened by lever with pull-chain external to door which safeguards against burns.
- Shutter is normally closed, preventing damage from "puffs" within the furnace.
- Shutter seat is cast integrally with main frame.
- Main frame and shutter are fin-cooled.
- With both cover and shutter full open, door becomes an effective poke hole with no danger of breakage of door parts by tools.
- Service tested on boilers, dryer furnaces, refinery heaters, kilns, metallurgical furnaces—all places where heat is at work.

Send for Bulletin 30 today!

BIGELOW LIPTAK Corporation

BIGELOW-LIPTAK

Unit-Suspended Walls & Arches

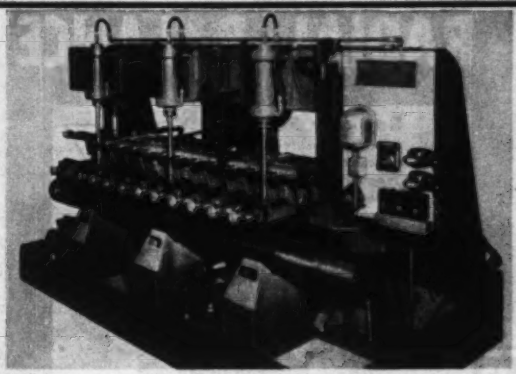
2550 W. GRAND BLVD. • DETROIT 8, MICHIGAN

IN CANADA

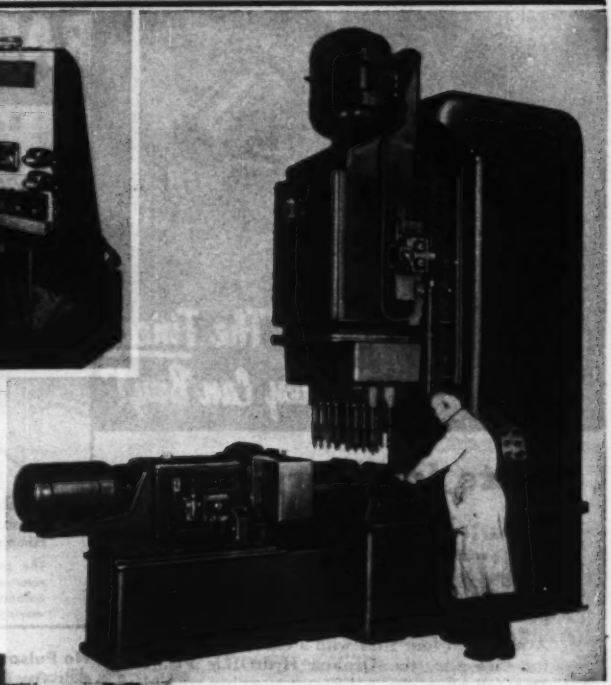
BIGELOW-LIPTAK OF CANADA, LTD., TORONTO, ONTARIO

ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DENVER • HOUSTON • KANSAS CITY, MO. • LOS ANGELES • MINNEAPOLIS • NEW YORK PITTSBURGH • PORTLAND, ORE. • ST. LOUIS • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SAULT STE. MARIE, MICH. • SEATTLE • TULSA • VANCOUVER, B.C.

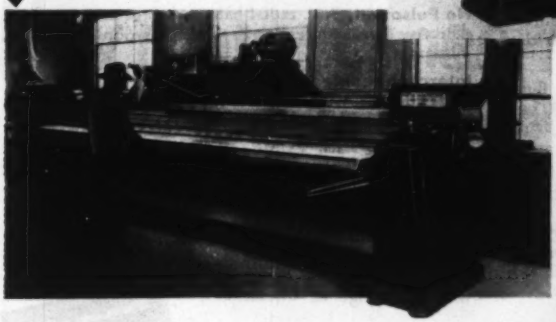
MORE COST-CUTTING APPLICATIONS OF VICKERS HYDRAULICS



Oil well casing slotting that formerly cost $1.25 per foot is now done at $0.90 per foot on the new machine designed and built by Allen Machine & Tool Co., Compton, California. Vickers hydraulic equipment raises and lowers the feed rail, controls feed rate and rapid traverse of cutters.



Hydraulic unit converted old belt sander to modern automatic stroke sander and reduced time for sanding pew backs from 15 minutes to 1½ minutes. Also improved quality. Built by Curtis Machine Corporation, Jamestown, N. Y. Vickers Hydraulics used exclusively.



This four-way, 38 spindle special purpose machine by Modern Tool Works, Ltd., Toronto, Ontario, does the drilling, spot facing and chamfering operations on an automobile engine head at the rate of one per minute. Vickers Hydraulic helps give it speed, control and precision.

Every day more and more machines are increasing production and cutting costs with the help of Vickers Hydraulics. See for yourself what Vickers Hydraulics can do for you . . . write for Catalog 5000 or call in a factory trained Vickers application engineer.

VICKERS Incorporated • 1500 OAKMAN BOULEVARD • DETROIT 32, MICHIGAN

DIVISION OF THE SPERRY CORPORATION

Application Engineering Offices: ATLANTA • CHICAGO (Metropolitan) • CINCINNATI • CLEVELAND • DETROIT HOUSTON • LOS ANGELES (Metropolitan) • NEW YORK (Metropolitan) • PHILADELPHIA (Metropolitan) PITTSBURGH • ROCHESTER • ROCKFORD • ST. LOUIS • SEATTLE • TULSA • WASHINGTON • WORCESTER

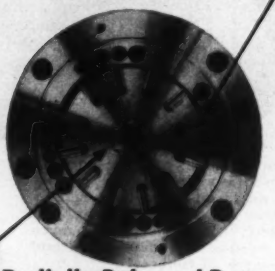
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

4763

Today's Biggest Value in a Hydraulic Pump or Motor

New Vane Design gives COMPLETE RADIAL BALANCE

Radially Balanced Vanes reduce vane load on the cam ring *regardless of operating pressures.* When system pressures increase, balanced vanes retain *low* loading characteristics for longer life.



Radially Balanced Rotor. Opposed inlet and outlet porting provides complete radial hydraulic balance of the rotor.

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PUMP MOTOR

The DENISON Engineering Co.
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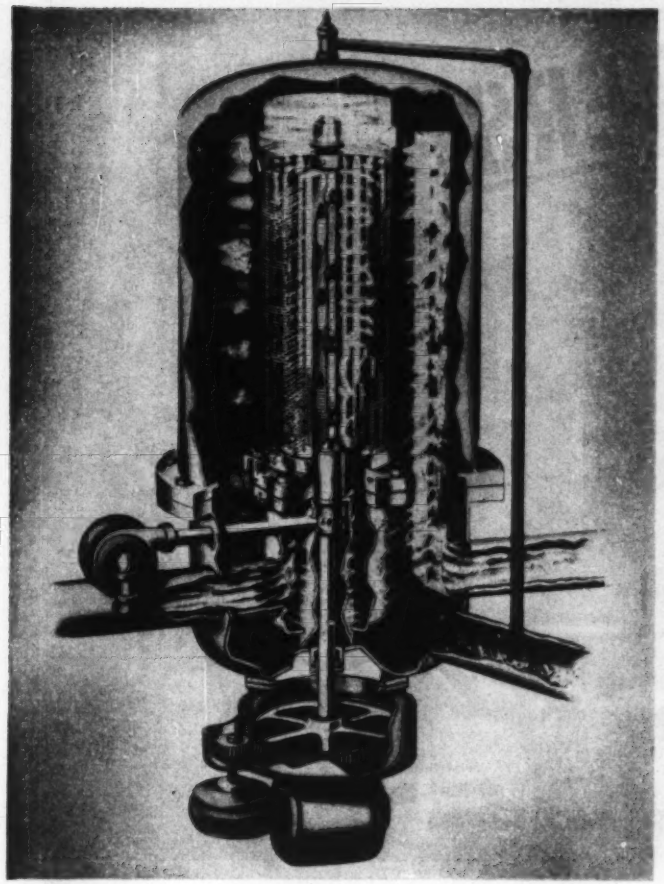

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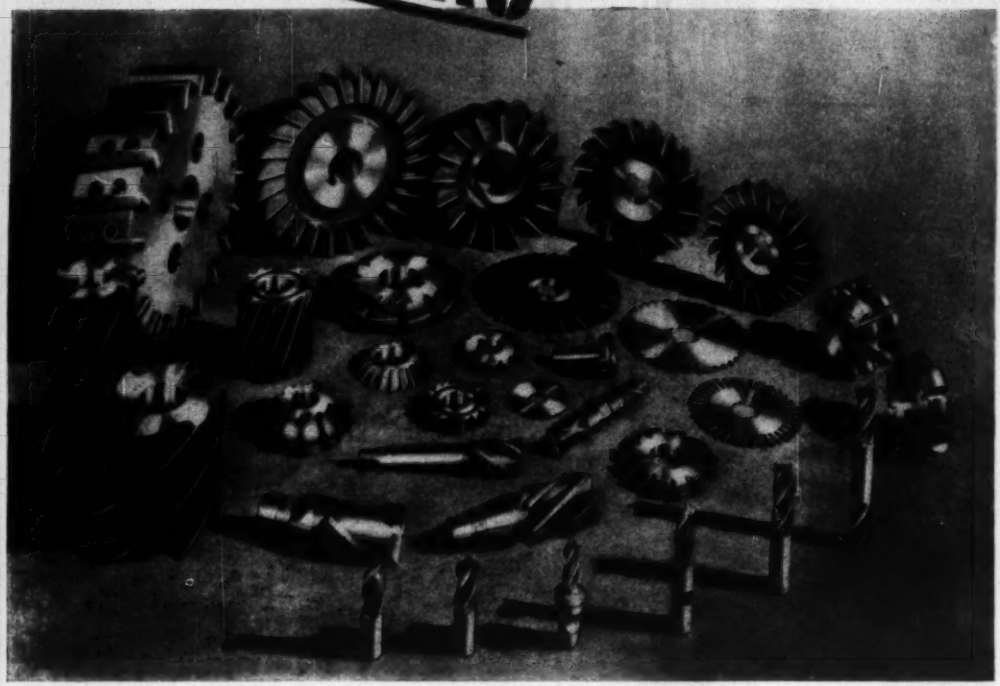

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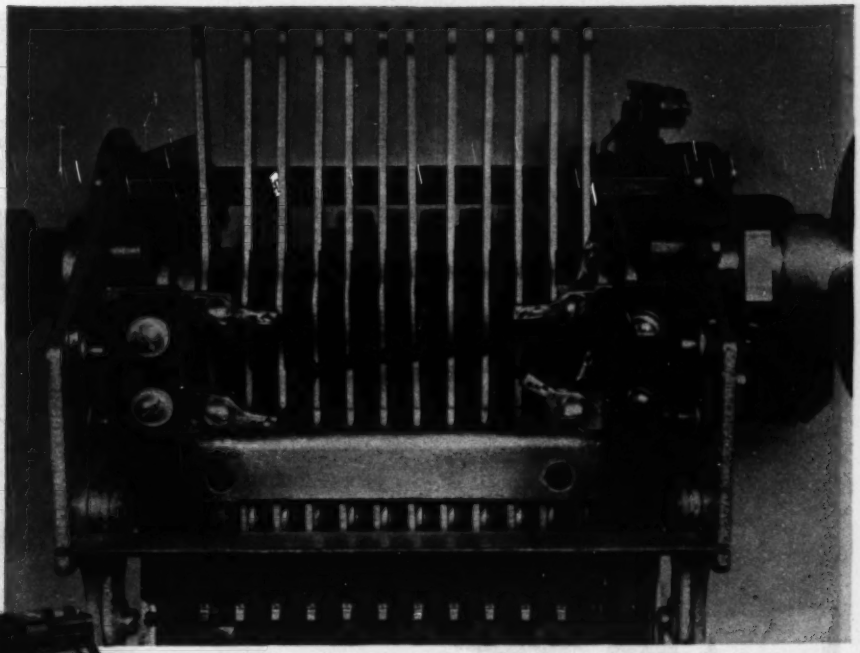

IBM punch magnet assembly, showing felt spacers

IBM Card Punch, made by International Business Machines Corporation, New York 22, N. Y.

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It is important to remember that felt often can do several things at the same time. Here is an example in which felt, American Felt, is used as a spacer, a source of lubricant, and a lubricant control. The machine is an IBM Card Punch, used to punch accounting cards rapidly, accurately, and cleanly. The felt spacers are used in the punch magnet assembly, at the point where the operating arms pivot to actuate the punches. The spacers are impregnated with oil, thus providing an ample and long-lasting source of lubrication at the exact points where wear or corrosion might occur between the fast-moving arms and the shaft. Another virtue of the felt is control; it eliminates the possibility of oil dropping down into the circuit breakers beneath the unit. Other IBM machipes of various types likewise use American Felt. There are some 16 chief mechanical functions for which American Felt is used, plus many subsidiary ones. It will pay you to investigate what American Felt can do for you in your plant or product. See the nearest Sales Office or write direct.

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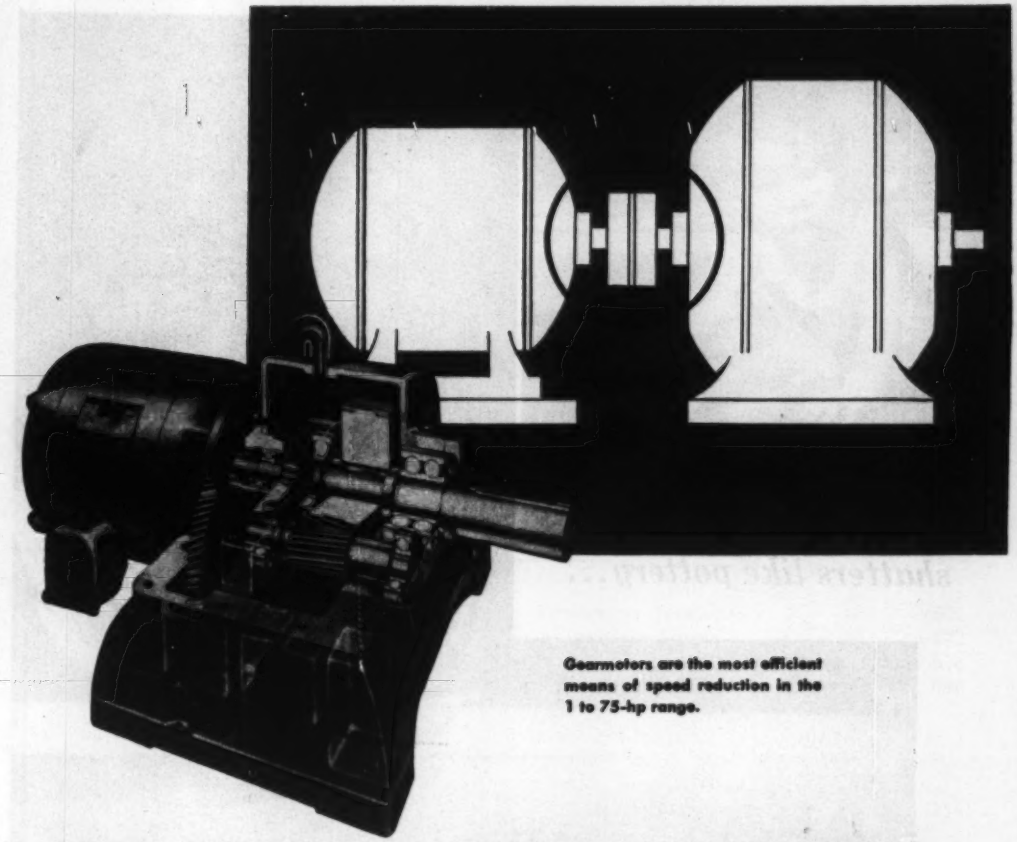

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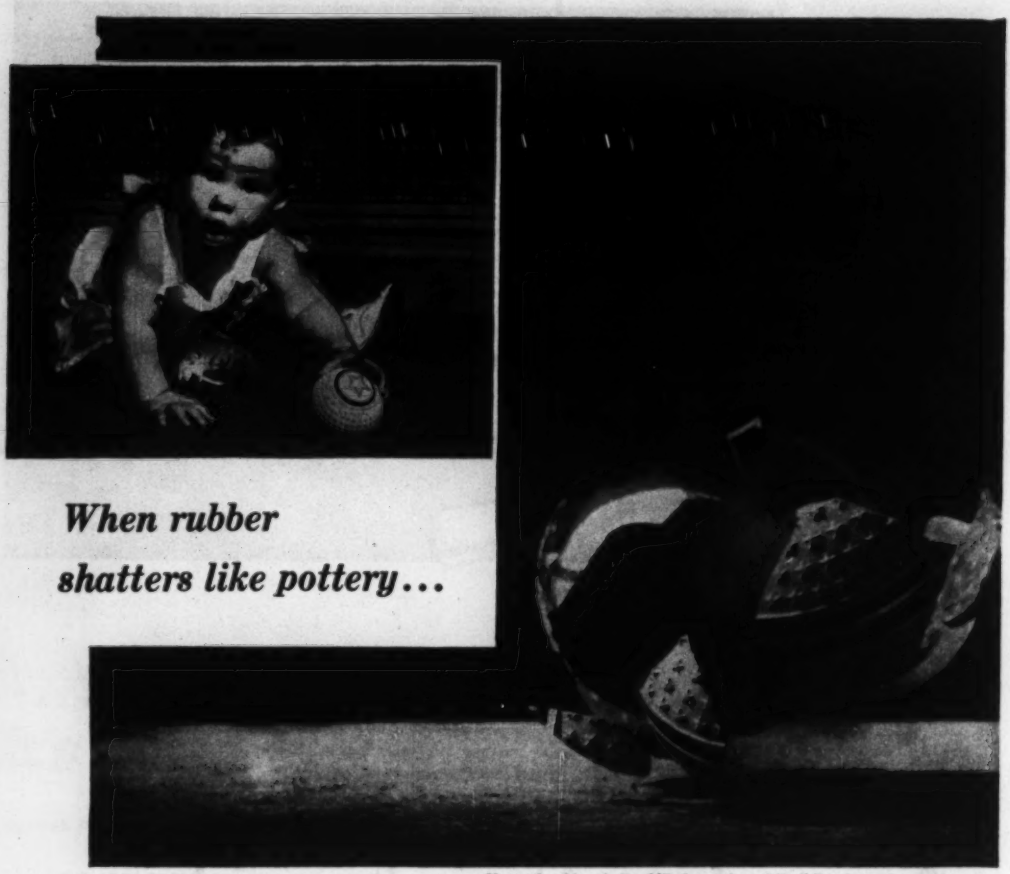

When rubber shatters like pottery...

Natural rubber ball, chilled to minus 320.4° F., shattering on impact. Electronic flash tripped by microphone 1.035 milli-seconds after contact. Photos by Ralph Bartholomew, Jr.

Natural rubber *will* shatter, up in sub-stratosphere planes, at minus 50°F. Don't shiver; that's *warm* compared to temperatures some chemical equipment must take in stride.

Put yourself in the shoes of the man who designs an oxygen vaporizer. It must test 4200 pounds per square inch at minus 300°F.!

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Now that's cold. At temperatures like that, an orange spalls off in little chips, like granite. Steel brittles like a bit of glass.

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Now is the time for us to get together with you or your engineers while our staff of metal specialists can carry out whatever research is needed to solve it. You can mail the outline of your problem direct to them for study by addressing it to The International Nickel Company, Inco Nickel Alloys Dept., 67 Wall Street, New York 5, N. Y.

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MECHANICAL ENGINEERING

Published by The American Society of Mechanical Engineers

VOLUME 74 NUMBER 8

Contents for August, 1952

THE PATTERN OF GAS-TURBINE DEVELOPMENT . . . . . *F. T. Hague* 627
WHAT STANDARDIZATION MEANS TO THE MECHANICAL INDUSTRIES . . *W. R. McCaffrey* 633
ENGINEERING USES OF ANALOG COMPUTING MACHINES . . . . *C. B. Crumb, Jr.* 635
THE ASME BOILER CODE
II—ASME SETS UP BOILER CODE COMMITTEE AND ADOPTS CODE OF 1914 . . . . . *A. M. Greene, Jr.* 640
A SUGGESTED FILING SYSTEM . . . . . *G. A. Hawkins and L. M. K. Boelter* 647
LET'S TAKE THE STRAIT JACKET OFF TECHNICAL STYLE . . . . . *R. L. Shurter* 649
PRICE CONTROLS IN MOBILIZATION . . . . . *E. C. Brown* 651

EDITORIAL 625
BRIEFING THE RECORD 653
ASME TECHNICAL DIGEST 665
CONTENTS OF ASME TRANSACTIONS . 670
COMMENTS ON PAPERS 671
REVIEWS OF BOOKS 672
ASME NEWS 676
ASME JUNIOR FORUM 699
ENGINEERING SOCIETIES PERSONNEL SERVICE . . . 700

CLASSIFIED ADVERTISEMENTS . . . 128
CONSULTANTS 134
ADVERTISERS 136

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Published monthly by The American Society of Mechanical Engineers. Publication office at 20th and Northampton Streets, Easton, Pa. Editorial and Advertising departments at the headquarters of the Society, 29 West Thirty-Ninth Street, New York 18, N. Y. Cable address, "Dynamic," New York. Price to members and affiliates one year $3.50, single copy 50 cents, to nonmembers one year $7.00, single copy 75 cents. Extra postage to countries not in the Pan-American Union, $1.50; to Canada, 75 cents. Changes of address must be received at Society headquarters four weeks before they are to be effective on the mailing list. Please send old as well as new address. . . . By-Law: The Society shall not be responsible for statements or opinions advanced in papers or . . . printed in its publications (B13, Par. 4). . . . Entered as second-class matter at the Post Office at Easton, Pa., under the Act of March 3, 1879. . . . Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized on January 17, 1923. . . . Copyrighted, 1952, by The American Society of Mechanical Engineers. Member of the Audit Bureau of Circulations. Reprints from this publication may be made on condition that full credit be given MECHANICAL ENGINEERING and the author, and that date of publication be stated.

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Special Shower Tester Used in the General Electric Company's Research Laboratory Can Check a Shower Without Taking One

(Showers are installed at strategic points in workrooms of the laboratory to douse a scientist in case his clothes catch fire or in the event of acid burn. Although rarely used, showers have to be in working order and are checked periodically. This special tester permits water from shower to be squirted into a large funnel, from which it is carried into a can. A hose conducts the water to a near-by sink.)

VOLUME 74
No. 8

MECHANICAL ENGINEERING

AUGUST
1952

GEORGE A. STETSON, *Editor*

Tribute to Applied Mechanics

TO one who has spent more than thirty years in close association with the publications of The American Society of Mechanical Engineers, the action of the ASME Council at the 1952 Semi-Annual Meeting in electing Stephen P. Timoshenko and John M. Lessells to Honorary Membership is significant and appropriate.

It is significant because it is an act of recognition of the importance of the field of applied mechanics. It is appropriate because both of the engineers so honored stand high in the roster of ASME members who brought the *Journal of Applied Mechanics* into being and developed it into the influential magazine it is today.

Although the Applied Mechanics Division of ASME had, as did all other professional divisions of the Society in 1927, a separate section of the Transactions devoted to papers contributed by it and of especial interest to its members, the plan under which these divisional publications were issued was short-lived and abandoned in favor of a monthly magazine that contained all Transactions papers of whatever origin. Even under this revised plan, at the urgent insistence of the Applied Mechanics Division, an attempt was made to concentrate in one or two issues all applied mechanics papers.

Leadership and interest in the field of applied mechanics, however, soon became so effective that strong agitation for a separate magazine to serve the broad and growing field extended beyond the limits of ASME membership. One recalls a meeting at Bethlehem, Pa., at which representatives of several learned societies, including the American Mathematical Society, and of a few scientific journals sponsored by industrial research laboratories and colleges, proposed the establishment of an international journal of applied mechanics. This magazine was to cover a variety of subjects grouped under that convenient title and contain papers from the entire world in the language of their origin. Thus would be provided a world-wide forum for the exchange of technical knowledge which would enhance the prestige of the American engineer.

In devising this ambitious plan the ASME Applied Mechanics Division exercised vigorous leadership. Attempts to put the plan into practice revealed the very real difficulties involved, not the least of which was financial. The ASME Publications Committee took an active part in the discussions from the start. It recognized the importance of the proposal and hoped that ASME would exercise vision and initiative in sponsoring the new venture. The international journal never materialized as it had been planned, but the Publications Committee did establish a quarterly publication by devoting the April, June, September, and December issues of the Transactions to papers contributed by the Applied Mechanics Division. Thus the *Journal of Applied Mechanics* was born.

In establishing the new quarterly, the Publications Committee, at the urgent insistence of the Applied Mechanics Division, permitted the inclusion in every issue of features not found in the other eight issues of Transactions—book reviews and design data. The book reviews extended the service of MECHANICAL ENGINEERING in this field. They have been ably and in some cases brilliantly written. The Design Data section was originated in the hope that the *Journal* would be able to provide designers with usable material, substantially in handbook form, based on some of the scientific papers. So successful did this feature become that reprints of it were issued in book form and found a market which soon exhausted the first edition. To date two such books have been issued, one on the strength of materials and the other on mechanics.

The first issues of the *Journal of Applied Mechanics* appeared in 1935 on an experimental basis. Society finances were at a distressingly low ebb. The Publications Committee established the fact that, over a period of about 10 years, approximately 20 per cent of ASME Transactions papers had been contributed by the Applied Mechanics Division. Hence it allotted funds from its Transactions budget in that ratio. To this the Division added something in excess of $1500 which the editorial board of the *Journal* solicited from universities, companies, and individuals. A total of 160 pages was published that year.

Even though the Publications Committee had satisfied itself that the *Journal* could be operated within the budget of the Transactions, the question remained as to whether the enthusiasm of the Division would persist throughout the years. That the Division would maintain high standards of quality in the papers selected for publication there was no question. It was also apparent that the literature of the subject was rapidly increasing in volume and that the number of potential readers was growing. But if the *Journal* itself were to be successful as an independent venture, it would require close, competent, and continuous editorial supervision. Could this supervision be maintained by the voluntary efforts of the Division? The Committee argued that by plucking four issues out of the monthly Transactions, a quarterly could be established with a minimum of change. Should the zeal of the Division abate, those four issues could be reabsorbed into the Transactions with a minimum of confusion. It had the situation well covered.

Time has shown that the apprehensions of the Com-

mittee were groundless. The Division set up an editorial board, with J. M. Lessells as technical editor. Not only did the board, for a number of years, solicit the necessary funds to supplement the Society's budget so that the quarterly could be issued; it took steps to make maximum use of its funds. It set high standards of quality. It insisted on brief papers. It stuck closely to its field, broad as it is. It established general specifications as to originality and treatment of subject matter. Its review procedures were thoroughgoing and painstaking. It insisted on revision and condensation when its standards were not met. It demanded properly prepared manuscripts and illustrations. And it dealt competently and effectively with the difficult task of selecting books and reviewers and of providing the Design Data material. Recently it has added a new feature, Brief Notes, to the *Journal* to afford opportunity for the early publication of material not yet in shape for final presentation as a formal paper. Its editor has co-operated wholeheartedly with the editorial staff of the Society and has assumed entire responsibility for the selection of material for each issue. It met the test of sustained interest and full support.

Applied Mechanics is a subject which cuts across all branches of engineering and knows no geographical boundaries. If the bold vision of an international magazine had to be tailored to fit the budget of ASME in 1935, the establishment of the *Journal of Applied Mechanics* soon demonstrated that a substitute had been found. Authors and readers alike soon looked upon the *Journal* as an international publication serving all engineers. A nonmember subscription list was built up and manuscripts are now received from all parts of the world. The 160 pages of 1935 grew to 436 in 1951.

Great as the success of the *Journal of Applied Mechanics* has been as a technical quarterly, some collateral influences it has exerted on the Society should be mentioned also. The *Journal* has attracted nonmember engineers to the Society and its work. Many of these engineers have joined the Society because of its activity in the field of applied mechanics. There is no doubt that the *Journal* has been a powerful factor in raising the prestige of the Society, particularly outside the United States. Popularity of the *Journal* with authors who wish their papers published in it has provided a wealth of material for meetings of the Division, and has kept quality standards at a high level. And the Division itself, which has a pride and proprietary interest in the *Journal*, finds in it a focal point for its endeavors and a permanent record of its contribution to the literature.

The long list of distinguished members of the Applied Mechanics Division who worked for the establishment of the *Journal* and have supported it since as officers of the Division and contributors of articles and reviews, will not be offended if in this instance, only two are named—Timoshenko and Lessells. Both of these men took an active part in persuading the Publications Committee to enter upon the venture. The Committee could hardly brush off so outstanding an authority as Timoshenko; and it fully appreciated the enthusiasm and practical suggestions of Lessells. For here was a man willing to work—to raise money and take on the task of the editor.

The election to Honorary Membership of Timoshenko and Lessells is more than a personal tribute to men who have contributed greatly to the field of applied mechanics. It is a tribute to and a recognition of the Division and the *Journal*.

Next Century of Engineering

THE Centennial of Engineering in the United States, which is to be celebrated in Chicago, Sept. 3–13, 1952, offers an opportunity to reflect on the basic characteristics of the engineering profession, to inquire into its function, and to establish a sense of direction in its development.

To one observer, whose relations with engineers in general and mechanical engineers in particular cover almost half a century, the purpose of engineering is most simply stated in Tredgold's definition, written in 1828, as "the art of directing the great sources of power in nature for the use and convenience of mankind." In so far as the mechanical engineer is concerned, this generalization may be broadly interpreted as the task of increasing man's creativeness and productivity. The function of engineering, as of all professions, has been succinctly stated by Vannevar Bush as being "simple ministration to the people." And the direction in which the engineering profession is headed, to paraphrase Dean Sinnott's phrase, the "whole man," is toward a "whole" society, using that term to mean a unified social goal, as well as a healthy and a complete society.

A profession has been aptly defined as a "state of mind," and one might characterize the engineering profession as being in essence a method of thinking. For just as a state of mind is necessary if a man is to accept the ideal of "simple ministration to the people," so a method of thinking is necessary if his work as an engineer is to be creative, productive, and practical. The engineer's method of thinking is an adaptation of the "scientific method" of observation and analysis of facts on which a program of action is then based, to which has been added a purposeful practicality in which efficiency and cost consciousness have high priority. It demands also a logical mind, flexible enough to deal effectively with illogical people and illogical situations.

The engineering profession is numerically small, but in a modern world based on an industrial civilization engineers occupy a strategic position. Their creative genius has provided a large proportion of the goods and services on which our economy is based. They have made significant contributions to the techniques by which enterprises are soundly administered. They bear an increasing portion of the burden of management. They have the vision, the will, and the way by which all elements of an industrialized society may be integrated into a peaceful progress toward the goal of a unified social order in which the freedom of the individual citizen is maintained and his happiness, prosperity, and the satisfactions of a full life may be attained. Further progress toward this goal is the task of the next century of engineering in the United States.

The PATTERN *of* GAS-TURBINE DEVELOPMENT

In Europe and the United States

By F. T. HAGUE

AVIATION AND GAS TURBINE CONSULTANT, WESTINGHOUSE ELECTRIC CORPORATION, PHILADELPHIA, PA. MEMBER ASME

THE announcement of the initial operation of three continuous-combustion gas-turbine power plants in Switzerland in 1940 and 1941, gave notice to the world that a new competitor was entering the field of commercial power generation. These three now historic plants are the Escher Wyss 2000-kw closed-cycle externally heated demonstration unit in Zürich, Brown Boveri's 4000-kw open-cycle emergency-service stand-by unit installed in an underground bombproof station in Newchatel, and a 2000-hp gas-turbine-powered locomotive on the Swiss Federal Railways system.

The challenge of these new-type plants aroused wide technical interest. The Swiss and the Germans by 1935 had accelerated their interest in the commercial possibilities of various forms of gas-turbine plants. In 1938 the German government placed contracts for jet-propulsion gas-turbine engines. The first recorded flight of a jet-propelled gas-turbine-powered aircraft was that of the Heinkel He 178 in August, 1939.[1] In England the first Whittle turbojet engine operated in 1939, and flew a jet-propelled plane first in 1941. These new Swiss power plants anticipated the beginning of the turbojet-engine development, and in so far as is known there was no interchange of gas-turbine technical information between these three countries. Theoretical study of the application of the gas turbine to jet propulsion of aircraft was begun in 1930, but it took a war to reduce it to practice.

Normal communication with Switzerland was disrupted by World War II, and factual information on these new plants was not published in the United States until late in 1945. For 7 years, from 1941 to 1948, no additional commercial gas turbines were put in operation due to war restrictions, various shortages, or the diversion of all available effort to government-sponsored aviation gas-turbine developments. The German turbojet developments were largely unknown to the U. S. public but the glamour of the English turbojet-engine contribution to revolutionizing military aviation kept interest in the basic gas turbine at a high level from 1943 on, particularly after the public demonstration of turbojet-propelled planes in the United States.

ENGLAND'S CONTRIBUTION

The leadership of the English in the contemporary reduction to practice of the turbojet gas turbine for aviation developed from government sponsorship of research projects at many individual plants and research organizations. The development projects were "planned" and directed by the Ministry of Supply with technical support through the medium of a Co-Ordinating Committee. In this way different-type projects were assigned by agreement with different manufacturers so that a wide scope of research coverage was obtained with a controlled or minimum amount of duplication of effort and expense. This is the invariant pattern under nationalization and they are generally well satisfied with its results.

The commercial gas-turbine-plant development in England is currently being carried on by a group of firms that have no aviation-engine activity, although they receive the full benefit of the nationalized gas-turbine research through committee contacts, and many share in gas-turbine research contracts from the British Admiralty. One basic premise of the English objective in gas-turbine development is to sell English technology in gas turbines as an export commodity. This is currently being done on a major scale through the sale of licenses to build complete turboengines or component parts in foreign countries in addition to the direct sale of turbojet engines to many European nations. Power Jets, Ltd., has been set up as the patent-holding agency for all types of gas-turbine patents secured through use of government development funds.

Interest in the gas turbine in the United States was stimulated by the Swiss projects and the wartime reduction to practice of the turbojet gas-turbine engine. With the termination of wartime restrictions, prototype gas-turbine power plants ranging from 500 to 5000 hp were built by firms in England and in the United States. Examples of these were 500-hp units at Parsons & Pametrada, a 2000-hp unit at Westinghouse, and a 5000-hp unit at General Electric. The United States Navy and Maritime Commission in 1939 sponsored the Allis-Chalmers Company and the Elliott Company to build gas turbines for research at Annapolis, and a 2500-hp marine gas-turbine prototype for ship propulsion. Naturally, many smaller research contracts on materials, combustion, and component developments were instituted with specialty groups.

The basic motive behind these projects was a recognized need for familiarization with the power-generation gas-turbine structure, its degree of conformity in performance to theoretical possibilities, and actual operating experience with long-life versions of this new high-temperature plant beyond the scanty information available from the early forms of short-life aviation jet engines. Prototype units were a proving ground for high-temperature metals, for performance levels of compressors, turbines, and so on. The attainment of the full theoretical possibilities of the new-type unit required building gas-turbine component research laboratories, Fig. 1, where rational development of all components could be pursued free of the interruptions and limitations of shop production and commercial test floors, and the like. These were created and there has been a steady growth of these facilities which will continue with the growth of the gas-turbine industry. Facility-wise, the United States has the laboratory capacity to do an outstanding development job.

[1] BIOS Overall Report No. 12.

Contributed by the Gas Turbine Power Division and presented at the Spring Meeting, Seattle, Wash., March 24-26, 1952, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

FIG. 1 TYPICAL GAS-TURBINE DEVELOPMENT LABORATORY

FUTURE POSSIBILITIES

The gas turbine will be commercially attractive in the long-term sense for one general reason, i.e., when it does a better job than any other competitive power plant. Doing a better job means that the evaluation and integration of all its characteristics, that is, first cost, size, cost of power generation, life, maintenance, and reliability puts it in a more favorable competitive position than any other type of power plant. Gas turbines will compete with and will supersede other types of power plants only when they "do a better job" in an evaluated sense.

Industry must evaluate the gas turbines that are available today while engineers are privileged to speculate on the possibilities of further improved economy by the successful development of many promising projects now in the research stage in component-development laboratories. It may be pardonable—in a look into the future—to state that the gas turbine is unique among heat engines because of the extreme flexibility in its relationship of physical size, cost, cycle efficiency, and top operating temperature. Continuous-combustion gas turbines up to this time have been limited to top temperatures less than one half that of Diesel engines. Obviously, the development of practical cooling means to allow the gas turbine to employ higher operating temperatures, while protecting its metal parts from the destructive effects of these temperatures, is the most effective type of development needed to give it a major boost in economy while at the same time actually improving its basic simplicity, reducing size by the elimination of heat exchangers, and lowering its cost. Cooling systems are being used in parts of present-day gas turbines but a complete cooling system such as used in Diesel engines is not available in commercial machines. Future improvements are more promising for the gas turbine than for any other form of heat engine.

The prospect of gas-turbine applications and the pattern of development being followed is basically similar but differs in essential respects in Switzerland, England, and the United States. The gas turbine in its present state of development is an economic and practical reality in all parts of the world for certain types of applications. These fields of application exist when either the cost of fuel, plant load factor or plant first cost is sufficiently low or where the advantages of small size, portability, or absence of water requirements can be evaluated. In the low-cost liquid- and gas-fuel regions of the world the complete gas-turbine plant outevaluates the complete steam plant in sizes up to 15,000 kw and this dividing line may be doubled within the next few years, as attractive new forms of gas-turbine plant now building are proved out in operation. In the abundant coal regions the steam plant is unchallenged by the gas turbine for large power generation and significant improvement in coal burning for gas-turbine use must be made before any change in this situation can take place.

COMMERCIAL GAS-TURBINE PRODUCTION IN SWITZERLAND

In Switzerland Brown Boveri has 21 sets built or building and has put in operation throughout the world 15 gas-turbine units totaling 90,000 kw.[2] These are open-cycle units with 1112 F top temperature and employ compressor intercoolers and regenerators in various combinations. The efficiency level at 1112 F of many of the units appears to be commendably high as compared to current levels in the United States. The reason is primarily economic and secondarily technical, but, regardless of the reason, the export situation is favorably affected by the high performance level, and the resulting cost level seems to be acceptable to the builder.

By United States standards an 1112 F gas turbine would weigh at least 100 per cent more than a 1400 F unit. This 1112 F is a steam-turbine temperature level, and gas turbines using it could mainly use conventional turbine steels instead of costly high-temperature alloys. The axial-flow compressors and turbines of these machines employ upward of two to three times as many stages as is conventional in modern United States practice. This increases weight but simplifies the design and adds materially to the efficiency. The accessory equipment (piping, heat exchanger, and so on) in these plants are well over double the size of those required on a 1400 F unit. Swiss labor rates are about 25 per cent of ours and conventional material costs are low. It is a tribute of the highest order that Swiss skill in technical design and manufacture can produce gas turbines of this type and sell them in the export market. It would be a short cut to bankruptcy for any United States manufacturer using United States labor and materials to build gas turbines to these design standards. We have what for United States conditions is a more attractive long-

[2] "Operating Experiences With Stationary Gas Turbines," by P. R. Sidler, MECHANICAL ENGINEERING, May, 1952, pp. 381–383, (condensed). Paper 51—A-104.

range objective that will correlate efficiency level, material conservation, and cost.

Brown Boveri has fully demonstrated the correctness of the previously stated principle that the gas turbine is unique because of the extreme flexibility in its relationship of physical size and cycle efficiency. By limiting designs to 1112 F this company has by-passed the high-temperature-alloy problem and avoided corrosion from vanadium ash in burning residual oil. It has demonstrated the widespread market for gas turbines in the low-cost-fuel regions of the world and has 15 units in operation with creditable service records. Their pattern of development apparently has not concerned itself with the high-temperature gas turbine or the development of compressors and turbines of high efficiency with what we call a minimum number of stages, presumably because these items do not conform with their economic or development program.

Escher Wyss, after demonstrating a high order of technical competence in the operation of its 2000-kw closed-cycle externally heated demonstration gas turbine, has built a 12,500-kw unit now in operation in the St. Denis Station in Paris. Its licensee, John Brown, Ltd., of Glasgow, is installing an essentially duplicate unit at Dundee, Scotland, scheduled for operation in 1952. A 700-kw waste-heat-utilization unit of the closed-circuit type is in construction for a gas works at Coventry, England. These projects have been described in considerable detail.[8] The commercial evaluation of these plants necessarily must await operation and test experience. The type of plant has potential possibilities of being built in sizes up to 50,000 kw with performance level comparable to the best steam plants. The temperature level of these 12,500-kw units is understood to be about 1250 F with the expressed belief that future units may be of higher temperature. The externally fired air heater is adaptable to coal firing, and the use of coal with lasting cleanliness of the closed circuit is most intriguing to operators.

Sulzer Brothers built a 20,000-kw semiclosed 1250 F gas-turbine plant that went into operation in 1950, in the Weinfelden Station of the North East Power Company. No formal publication of operating experiences has been published, possibly due to extended difficulties with vanadium-ash corrosion from the grade of oil used plus the working out of the teething troubles that are inherent on any entirely new plant of this size and uniqueness of construction.

The entire Swiss experience might be summed up by noting that the absence of aviation gas-turbine development projects in Switzerland has shielded them from the stimulus of undertaking the higher-temperature gas-turbine research that many in England and the United States feel is the logical goal of the gas turbine of the future.

POWER-GENERATION PROJECTS IN ENGLAND

The nonaviation gas-turbine situation in England is strongly supported by government funds through contracts with private firms. This is part of an over-all plan to have England develop technical leadership in all kinds of gas turbines and to sell profitably such technology directly or through patent licenses throughout the world. In 1945 an instrument of the nationalized government, the British Electrical Authority, apparently decided to invest in power-generation projects which would advance England's technological position in this field by actual experience through design, building, and operation of large new gas-turbine units. As a result, contracts for 15,000-kw units were let to Metropolitan Vickers and Parsons. A third contract was let by the Scottish instrument to John Brown, Ltd. of Glasgow, for a 12,500-kw closed-cycle unit of Escher Wyss design for installation in Dundee. All three units are expected to go into operation in 1952. Supplementing these are a 10,000-kw Parson's unit for the National Gas Turbine Establishment at Farnborough to provide power and district heating. See Fig. 2.

All of these units are in the nominal 1250 F class and employ the elements of intercooling, regeneration, and reheat in varying degree to further the knowledge associated with their use in contributing to high-efficiency operation. No formal report would be expected until they have had operating experience, but it is understood that the experience gained to date has been valuable from the constructional and material standpoints and will provide essential guidance for the future pro-

[8] "Closed-Cycle Gas Turbine, Escher Wyss AK Development, 1945-1950," by Curt Keller, Trans. ASME, vol. 72, 1950, pp. 835-850.

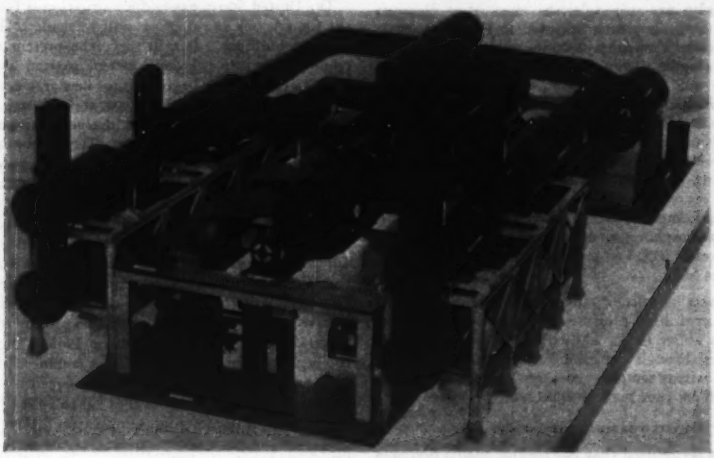

FIG. 2 10,000-KW GAS TURBINE AT N.G.T.E.

gram. As initially constructed these are all oil-burning units.

Other gas-turbine projects of the Admiralty include naval propulsion prototype units of 6000-hp capacity by the English Electric Company and Rolls Royce, plus a 1000-kw unit by the Allen Company.[4]

In the commercial field the following additional projects are in construction or operation:

British Thompson Houston Company:
1 1200-hp unit in operation on the tanker *Auris*
Metropolitan Vickers Company:
1 2000-kw unit in operation in its shop powerhouse
1 2500-kw building for Metropolitan Water Board
1 1750-kw building for Venezuela
1 3500-hp locomotive building for British Railways
English Electric Company:
1 1875-kw unit for Metropolitan Water Board
2 20,000-kw units for Ministry of Supply
Ruston Hornsby Company:
1 750-kw unit for general industrial use.

To understand the domestic gas-turbine power-generation prospects in England one must recognize that the cheapest fuel oil costs twice as much per heat unit as local coal. The significance of high-cost fuel oil is that its use cannot be justified economically for base-load power-generation gas turbines unless the efficiency of these units relative to a coal-burning steam plant can be raised sufficiently—and without appreciable cost—to pay for the use of the expensive oil Since this objective cannot presently be met by going to high-temperature operation, the market for gas turbines for domestic use is very limited in England. Current installations are for technological experience, training for export, or other special cases such as emergency power or government service applications.

FUTURE BRITISH OBJECTIVES

This local situation has provided the stimulus for the Ministry of Fuel and Power to inaugurate an extensive program to develop a coal-burning system for use with gas turbines for primary power generation and locomotive use. Mr. Roxbee Cox, chief scientist of the Ministry, outlined these projects in his Thomas Hawksley lecture of November, 1951, before The Institution of Mechanical Engineers as follows:

1 Parsons' 500-hp gas turbine with "dry" type ceramic-lined combustion chamber which operated in February, 1951.

2 English Electric Company 2000-kw gas turbine with regenerator and "slagging" type of vortex combustion chamber.

3 Metropolitan Vickers 2000-kw gas turbine with pressurized gas producer designed by Incandescent Heat Company and Joseph Lucas Company.

4 Parsons and North British Locomotive Company 1600-rail-hp coal-burning locomotive with externally fired atmospheric air heater.

5 John Brown Company 1000-hp coal-fired closed-circuit gas turbine with atmospheric air heater.

6 English Electric 2000-kw gas-turbine plant using "fire damp" mine gas as fuel.

The "gas producer" project (3) is similar in some respects to the N.A.M.-Lurgi high-pressure coal-gasification project begun in Germany about 1944. Only about 10 per cent of the turbine flow passes through the gasifier so that the ash-cleaning problem is relatively simple. An over-all coal-conversion efficiency above 80 per cent may be expected.[3]

1750-F GAS TURBINE NOT FAR OFF

It has long been recognized that gas-turbine plants designed for high pressure ratio (up to 20 to 1), with a temperature level above 1500 F, can dispense entirely with the conventional regenerator and, when high-efficiency compressors and turbines with low-pressure-drop combustors and intercoolers are employed, can develop an efficiency level comparable to that of present-day plants of conventional inlet temperature using regenerators. The intriguing features of this concept of plant are the almost complete absence of bulky hot piping around the unit, a large reduction of plant size owing to the omission of the regenerator, and a substantial cost reduction for the parts eliminated including a smaller powerhouse. A high-pressure-ratio plant would only subject the first few turbine stages to a temperature in excess of present standards, and a simple cooling system to take care of these stages would make it possible to build the entire turbine except blading of nonstrategic low-cost steam-turbine materials.

The necessary high efficiency of the compressor and turbine components seems certain to be attained within the next few years. These developments will make possible a high-efficiency compact gas-turbine plant of low cost free of the cumbersome nightmare of bulky piping and auxiliary apparatus. This type of plant would be a great stimulus to the acceptance of the gas turbine and shortly the idea will be reduced to practice. See Fig. 3.

The gas turbine for bus, truck, and auto propulsion has been a British objective since the first unit was displayed in 1945. The simple gas turbine has a most attractive light weight but its fuel economy is extremely poor. There is need for a very small light regenerator of high effectiveness to make the gas turbine comparable in fuel consumption to the Diesel engine. Continuous British effort has been maintained to develop a "Ritz" type rotating regenerator which would meet these requirements. The design of the seals between the high and low-pressure air circuits has been a bottleneck and there is optimism that this problem is near solution. It appears that commendable progress is being made in this field although it still remains to be demonstrated what unique benefits the gas turbine will confer on automobile transportation for personal use.

DEVELOPMENTS IN THE UNITED STATES

The United States gas-turbine situation is better known than the foreign one so no effort will be made to list all the units built or building. It will serve the present survey purposes to outline briefly the development pattern and mention such units as marked the beginnings of new services.

The aviation gas turbine got started late in 1941 by the award of three research and design contracts to the three larger turbine manufacturers. The Navy awarded design contracts for the components of a research-type nonaviation unit for Annapolis, and a contract for a 2500-hp marine propulsion unit. These units operated in 1944. The two larger turbine builders were acquiring gas-turbine experiences through the building of aviation units and for a variety of reasons did not produce their first land units until well after the end of the war with its manpower and material restrictions. The first large unit to operate was the Westinghouse 2000-hp locomotive gas turbine in 1946, which was followed by the General Electric 4800-hp locomotive unit in 1948. These units marked the beginning of the United States commercial story.

The early pattern of gas-turbine development was characterized by a temperature level (1350 to 1400 F) which required the extensive use of high-temperature alloys. At this time there was no clear understanding of the long-life capabilities of available alloys or the certainty of production of alloys of materially better high-temperature qualities. Actually, the

[4] "*The Oil Engine and Gas Turbine*, December, 1951.

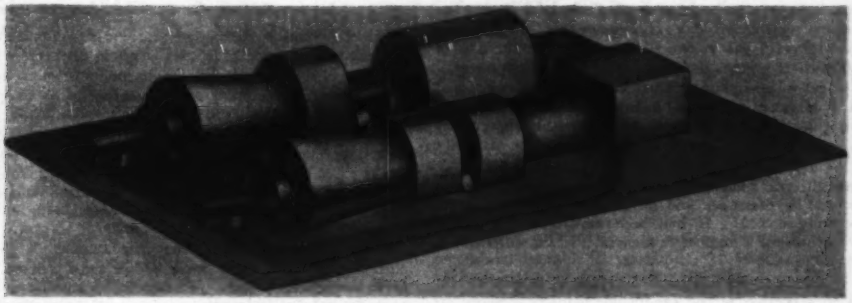

FIG. 3 FUTURE GAS-TURBINE PLANT, 20,000 TO 50,000 KW

alloys in commercial use today are basically the same type as the industry started with but there has been a very commendable improvement in uniformity and quality with better knowledge of processing and optimum heat-treating requirements.

In the later stages of the war there was excellent collaboration under government sponsorship between the alloy producers, processors, and testing laboratories. The metallurgist has not really failed to produce a super-high-temperature alloy. It is, rather, that nature has not to date made available the ingredient elements as currently processed that are required to meet the specifications of the gas-turbine designer who must have strength and long life at high temperature plus precious ductility for safety. To date we cannot have our cake and eat it too! Ingenuity in design must be encouraged to provide the benefits of high-temperature performance without the availability of super-metals.

CURRENT PROBLEMS

The war had given us a general idea of how many aviation gas-turbine units might be required per year under assumed normal and emergency conditions. It was soon apparent that certain of the ingredient elements of high-temperature alloys might not be made available in sufficient quantity to meet foreseeable future needs. It was realized that nonaviation gas turbines must conserve on strategic metals and the more conservation the better the prospects of some availability for commercial manufacture. There is an equally compelling reason in the competitive cost situation of the complete gas turbine. Large castings and forgings of these alloy materials cost 3 to 10 times as much as steam-turbine materials and it is desirable on a cost basis to be able to restrict the use of these materials to the hot portion of the blade path.

The practical answer to both the strategic-material and the cost situation for United States conditions involves design premises. Turbines and compressors are most easily designed for high efficiency when large numbers of stages are used, as evidenced by Swiss designs. Considerable research and design effort already has made commendable progress in reducing up to 50 per cent the number of stages of these components with an actual improvement in efficiency level. The multistage axial-flow compressor, which is generally considered to be limited by blade-profile losses to a theoretical small-stage efficiency ceiling of 94 per cent, is steadily being improved through continued research programs with promising prospects that complete machine peak efficiencies of the order of 90 per cent may be achieved shortly and with relatively few stages for conventional pressure ratios. This type of progress fits perfectly into a desirable future pattern for the nonaviation unit.

The savings of strategic materials, weight, and cost resulting from the use of a minimum number of turbine stages compatible with a desirable efficiency level have been analyzed thoroughly by gas-turbine groups. There is still considerable to be learned about the economics of taking high-temperature and pressure drops across the entering turbine stages of industrial turbines. This practice fits into a United States design pattern and is a factor in the efficiency level of United States gas-turbine plants being somewhat lower than European ones.

In the United States commendable progress has been made in using steam-turbine materials for rotor and stator parts—except blades—of gas turbines up to 1500 F inlet temperatures. This has been accomplished in part by employing various types of water and air cooling. Illustration of this trend was provided at the 1951 Annual Meeting of the Society. Papers[5,6] were presented describing constructional features of the world's first 5000-hp gas turbines being built for pumping natural gas and showed agreement in principle on cooling trends with different methods of execution. To date commercial gas turbines of conventional temperature level are being cooled to conserve the bulk of strategic material otherwise required. No system of cooling has yet been demonstrated publicly which permits substantial increase in operating temperature above present level while still shielding the metal parts from the destructive effects of such increase in temperature. It can be said that substantial progress is being made to achieve this objective. This pattern of development will steadily improve the competitive position of the United States power-generating gas turbine in comparison with the steam-turbine plant for many types of applications in low-cost-fuel regions.

In the power-generation field the General Electric Company is reported to have two 3500-kw and three 5000-kw units in operation and several more units under construction. Westinghouse has one 5000-kw and one 15,000-kw unit on order for installation in 1952 and 1953.

RESIDUAL-OIL AND GAS FUELS PROMOTE USE OF GAS TURBINE

There are very few locations in the world that present the same attractive combination of low fuel cost and large indus-

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[5] "The Gas Turbine's Contribution to Gas Line Piping," by T. J. Putz, Paper No. 51—A-102, presented at the Annual Meeting, Atlantic City, N. J., November 25-30, 1951, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

[6] "Design Features of 5000-Hp Gas-Turbine Plant," by B. O. Buckland and D. C. Berkey, Paper No. 51—A-113, Trans. ASME, vol. 74, 1952, pp. 655-661.

trial electric-power consumption as the cities located near the southern and western oil and gas fields of the United States. The availability of gas at one third to one fifth the cost of coal makes these regions most attractive for economic installations of gas-turbine plants. In these regions where residual oil sells for less than one half of its price in the eastern regions, the gas-turbine locomotive has its most favorable opportunity to be competitive with the Diesel locomotive for main-line service.

General Electric and Westinghouse have had demonstrator locomotives in passenger and freight service with creditable operating records. It has been reported that Union Pacific has ordered a number of General Electric units for its service.

The residual-fuel-oil situation contains a hazard to the growth to a portion of the gas-turbine industry. Many gas turbines in power-generation service and locomotive service must use No. 6 residual fuel oil to operate at an economic cost. Some of the domestic oil and much of the imported oil contains an undesirable amount of vanadium or sodium ash in conjunction with its other ash constituents. Gas turbines using the worst of these oils from this standpoint are prone to blade ash deposits and corrosion under certain conditions. Certain alloys, particularly those containing molybdenum and cobalt, are believed to be unusually vulnerable to corrosion when undesirable ash combinations are in the gaseous or molten condition under high-temperature operation. Too little is known at this time of the basic problem to permit more than an outline of the causes to be stated. There is every expectation that the research being carried out by oil producers, operators, and gas-turbine builders will find a solution to this problem, possibly through the use of inhibitors or surface coatings on the metals. Until brought under better control, however, some selection in the use of oils is necessary at present.

COAL-BURNING GAS TURBINES

Coal-burning gas-turbine research in the U. S. has taken the form of many individual combustion projects by private firms and the Bureau of Mines. The largest project covers the development of a complete coal-fired gas-turbine plant for locomotive use. This project was initiated and financed by several railroads and coal-mining companies in the interest of extending the use of coal. The project administration of this complete coal-burning project is by the Locomotive Development Committee of Bituminous Coal Research Inc. For the past four years an annual progress report has been published in the Proceedings of the American Power Conference.

The current objective of the project is apparently the development of a 4000-hp locomotive test-plant installation at Dunkirk, N. Y., and the keeping of a contemplated locomotive design in a current condition for quick building if authorized. The record of detail projects researched and equipments developed is far too extensive for review here. A wealth of experience has been accumulated on coal-handling systems, coal pumps, pulverization, combustor types, ash-removal systems, and blade erosion as well as operating experiences and other problems. This experience should be of material assistance to any coal-burning gas-turbine power projects that later may be undertaken by others.

The premises of this project involved a limitation in size of components suitable for a locomotive application and the processing system for coal preparation within these dimensional limits. Stationary gas-turbine plants, free of these dimensional limitations, would have more freedom in the selection of the coal-handling and combustion system.

USE IN PUMPING NATURAL GAS THROUGH PIPE LINES

The contribution of the gas turbine to natural-gas pipeline pumping in lines 20 in. and larger in diameter will be in the form of reduced capital investment for stations and lines and a lower cost per unit of gas transported as compared to gas-engine-driven reciprocating equipment. While a large number of gas-turbine-driven centrifugal-compressor units have been reported sold, only one (January, 1952) has been in actual extended operation in gas-line pumping. An 1800-hp Westinghouse pumper unit was put in operation on the Mississippi River Fuel Corporation line in May, 1949, and is still in service although moved to a permanent station. Various authorities have estimated that the amount of gas transported across state lines through pipe lines will be doubled in the next 10 to 20 years. To handle this increase an addition of 4,000,000 hp in pumping units will be required. This represents by far the largest potential market for gas turbines in this future period.

Smaller gas turbines up to 500 hp for automotive, mechanical drive, and auxiliary power services are being developed extensively, mostly by West Coast organizations. Boeing has developed a truck-drive unit which has attracted national attention from its performance in the heavy-truck field. Quantities of 200-hp units are understood to be on order. Solar has developed[7] a 250-hp unit for emergency power shipboard service and a 45-hp fire-pump drive for Navy application. Continental has foreign license rights and has developed several auxiliary power units for shipboard service; Fairchild Engine and Aeroplane Company has announced plans to build units under a French license; Air Research in the aviation field has developed gas-turbine-powered engine starters and auxiliary power units. In many types of application the versatility of the basic gas-turbine cycle makes it possible to "tailor-make" the gas turbine for the type of job to be done. Cost, performance level, or size and weight may be interchanged in a wide range of latitude to fit the gas turbine into the small-size unit field.

"SIMPLICITY" OF GAS TURBINE AN UNDERSTATEMENT

Much has been written on the basic simplicity of the gas turbine. The concept is simple but the execution of large projects of the high-performance-level power-generation class is bringing a realistic evaluation to this "basic simplicity" in terms of thermodynamics, mechanics, aerodynamics, combustion, metallurgy, and manufacturing techniques in processing new alloys and creating unmachinable blade contours for highest-efficiency compressors, and so on. The technological requirements of an organization in this field are more extensive than those of an integration of all the organizations involved in creating a complete steam plant with its component auxiliaries. The technological problems are similar in a basic sense except the gas turbine has relatively untamed aerodynamic problems in the compressor, and the design, material, and processing problems of gas-turbine plants are more exacting in a technical and practical sense. The gas-turbine plant in a commercial sense is so new that the obligation to develop a creative design pattern for the future is a requirement for constructive leadership in this field and this involves extensive research programs with expensive facilities. The problems and possibilities are intriguing to the engineering profession, and many organizations are learning that this alleged basic simplicity can be an understatement.

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[7] "Design Features of a 250-Kw Gas-Turbine Engine for Driving a Shipboard Emergency Generator," by R. R. Peterson and P. G. Carlson, MECHANICAL ENGINEERING, vol. 74, March, 1952, pp. 197–201.

What STANDARDIZATION *Means to the* MECHANICAL INDUSTRIES

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CHARACTERISTICS AND FUNCTIONS OF CSA

I WOULD like to correct any misunderstanding that may exist relative to the status of the CSA, and my first point is in the form of a negative statement—the CSA is not a government organization in any respect. It is fortunate, however, in having a close relationship with the National Research Council, through which it is the recipient of a small annual grant in recognition by the Canadian Government of the service being performed by the CSA in the interest of the industry and the citizens of Canada, in fulfilling its function as a national standards body to establish standards of sound up-to-date practice for the producer and consumer interests in Canada.

The association was incorporated in 1919, under the Dominion Companies Act, as a nonprofit organization, authorized to carry out standardization and related activities over an extremely broad field of operation, embracing materials, products, and codes of practice, in the interests of economy in production and safety in use.

CSA activities are entirely of a voluntary nature; i.e., it is not the practice of the CSA to tell industry that problems exist but rather that, if they do exist, the CSA will willingly provide its services if standardization is a factor in the solution of such problems.

The work of the CSA is carried out by committees whose members are nominated by the interests concerned, with due regard to balancing of representation of producer and consumer interests and geographical distribution of such representation.

The voluntary nature of CSA operations extends to the service given by individual committee members because of the fact that they receive no remuneration for the work they do in a standardization project. Their only reward is gratification in the knowledge of a job well done.

Approximately 150 committees and subcommittees are active in the CSA, totaling in membership approximately 1500. A project of standardization is initiated and an appropriate committee is organized only if there is evidence of a need for standardization of a specific subject, and on assurance of a broad application of the resulting standard after the committee work is completed.

In other words, the CSA does not establish standard specifications or codes of practice merely for the sake of adding new subjects to its list of publications, but specifically because there is evidence that such standards will be of value to both producers and consumers. Consequently, I may stress the fact that the work of standardization is not done for the CSA but through the CSA which acts as a medium of co-ordination or unification of opinion where, originally, a broad diversity of opinions existed.

WHAT DO WE MEAN BY "STANDARDS"?

The term "standard" means accurately defined processes, sizes, qualities, and tests of materials and equipment that have been generally agreed upon by makers, users, and the public, as proper and desirable for general use. A standard may be brief, only a sentence or a paragraph, while again it may be a very long, and in some cases a highly technical document.

Standards represent a vital economic need, and have a beneficial effect on the national economy.

The advantages of standardization have been recognized by some of the Canadian industrialists for many years, and the economic problems that develop during periods of war have been found to be a great incentive toward development of national standards.

TYPES OF STANDARDIZATION

There are three principal types of standardization, viz., *fundamental*, *functional*, and *dimensional*.

Fundamental Standards. Such standards generally concern the subjects of weights and measures, and activity in this field is, as can be understood readily, under the jurisdiction of national governments.

Functional Standards. These standards are designed to achieve fitness for purpose. They may deal with terms, symbols, and definitions; with quality, from the viewpoint of composition and performance; with methods of test to remove misunderstandings as to procedures for measuring and for analyses; with codes of practice or methods of use for the purpose of obtaining adequate results and safety in use.

Dimensional Standards. These are standards which, by achieving simplification, unification, and interchangeability, eliminate duplication of effort and multiplicity of designs and methods, in the production of articles fundamentally similar.

The CSA is engaged in the development of both functional and dimensional standards.

WHAT DO STANDARDS ACCOMPLISH?

The co-ordination of basic designs and the simplification of practices involved in the production of similar articles contribute largely to the elimination of economic waste. It also permits reduction of a large proportion of dormant capital tied up in the stocks of the manufacturer, the jobber, and the retailer.

Standards have four distinct values, as follows:

(*a*) They educate by setting forth quality goals for the guidance of producers and consumers alike.

(*b*) They simplify by limiting the number of sizes, the variety of processes, the amount of stock, and the associated paper work—thus reducing the overhead costs of manufacturing and selling.

(*c*) They conserve by cutting down the losses, wastage, and unnecessary tooling that accompany odd-lot manufacture, thus promoting large-scale production of standard design.

(*d*) They certify by serving as hallmarks of quality and value.

In brief, standards make it possible to provide more goods at lower cost, and enable buyers to determine and evaluate the goods that they require.

Presented at a meeting of the Ontario Section, Toronto, Canada, February 14, 1952, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

An executive of one of Canada's largest industrial organizations recently made a very concise statement concerning standardization of bolts, screws, and rivets as it affected his company. His statement was as follows:

"A range of 1170 types and sizes of steel carriage, machine and lag bolts was reduced to 380; slot-head wood screws from 540 to 225; stove bolts from 364 to 200; machine screws from 1224 to 569; and rivets from 178 to 65."

This is only one example where savings all down the line from the manufacturer through the distributor, the jobber to the consumer, have been effected through standardization.

The value of standardization is broad in its distribution, and a detailed examination of the effect of the application of standardization principles would, I believe, indicate that the resultant savings are much deeper than the "apparent" benefits.

A survey to determine the degree of savings derived from the use of standards in industry in the United States is at present being conducted by the American Standards Association among its members, under the auspices of the (ECA) Economy Cooperation Administration, based on the principle that standards in industrial practices usually develop savings in many stages of production and distribution.

The investigation is being worked out by a system of cost accounting which includes the details of procurement, engineering, manufacture, distribution, and miscellaneous general items. A standard check list has been drawn up to include many details of cost under these various headings and is based on records before and after applying recognized standards.

Data already obtained show some interesting examples of savings. To quote only a few: Mr. E. H. Weaver of the Union Oil Company, reports a simple case concerning funnels carried on gasoline delivery trucks. Through standardization of these funnels, the cost was reduced from $20 to $11 each, or a saving of 45 per cent.

Mr. Thomas D. Jolley, vice-president of the Aluminum Company of America, reports the elimination of odd sizes and shapes, quoting, specifically, the case of special angle cutters for machine dies, which were reduced from 75 to 28 in number, resulting in a saving of $10,000 a year for these tools alone.

A senior executive of General Motors Corporation recently stated that standardization is the "number-one weapon" against high manufacturing costs and that the corporation is organized on a plant-wide program of standardization.

It will be interesting and informative to examine the report of the survey being made by the American Standards Association, when it is summarized.

Coming closer to home, the president of a Canadian firm manufacturing heavy electrical equipment, stated a few years ago that savings realized by the manufacturers of transformers, on this continent, through the medium of standardization known as "simplified practice," which, in effect, eliminated certain ratings in transformer production, had run into a total of hundreds of thousands of dollars over a short period of years.

CSA METHOD OF OPERATION

May I reiterate that the operations of the Canadian Standards Association are entirely on a voluntary basis and the actual developing of standards is attempted only when there is a stated and recognized need for them.

It is important to note that all CSA standards are established on the basis of minimum requirements and therefore manufacturers are not restricted in the matter of producing articles of better quality and of greater endurance than those provided by the basic standards.

CSA standards are always subject to revision, as soon as the need for change is apparent, so that new standards may replace the old as invention and progress in the art develop. Obviously, the progress of industrial design and practice must not be retarded by the handicap of obsolescence in basic standards, and it is important that standards should not in any way act as a barrier to the free development of new and varied designs.

I have stated that the CSA acts as a medium for the coordination of opinions of nationwide interests. It also should be noted that it is not the function or practice of the CSA to tell any industry how its products should be made, except of course in the interests of safety. In such cases the CSA acts as the agent of authorities having jurisdiction, who must establish certain safety measures in the interests of protection of citizens coming within their spheres of jurisdiction.

The actual detail work of standardization is carried out by experts representing the producers and consumers, technical and research organizations, and so on, who are directly interested in the establishment of a specific standard.

MANDATORY STATUS OF CSA STANDARDS

All standards published by the CSA represent recommended acceptable practice and, consequently, do not have a mandatory status until adopted by an authority having jurisdiction. Such authorities may be Federal Government departments or agencies, Provincial Government Inspection Departments, company purchasing agents, factory superintendents, design engineers, architects, and so on, who may adopt certain standards as the basis of their operations.

In many cases, Safety Codes of the Canadian Standards Association have been adopted by Provincial Governments and have been given the force of law through "orders-in-council" or regulations of the respective governments.

An outstanding case of this nature is the Canadian Electrical Code, which was established as a recommended code of practice of minimum standards and essential requirements relative to inside wiring. This includes the wiring of buildings, the installation of electrical equipment, and the construction of domestic and industrial electrical apparatus and appliances.

I would like to assure my readers that the services of the Canadian Standards Association are available to them whether or not their respective organizations are sustaining members of the CSA. We will welcome recommendations for standardization on a national basis. I would suggest that there are many standards which have been established by individual companies, that would serve as national standards after processing through the Canadian Standards Association in consultation with other producers and with consumer interests, on a nationwide basis.

Savings which may be realized by individual companies can thereby be extended to similar organizations with the resultant greater and widespread savings in production and distribution costs, involving time and materials, that will have an extremely beneficial effect on the national economy.

The CSA enjoys the support of approximately 1000 industrial organizations and Governmental Departments of Canada who have shown their appreciation of the value of national standardization work being done by the CSA, by subscribing to Sustaining Memberships in the Association. I would be remiss if I did not bring this matter to your attention and solicit the support of your respective organizations, if they are not already on our Sustaining Membership list.

I also would like to say a word about the use of CSA established standards. There are a considerable number of these in the mechanical field and in the related fields of interest, such as ferrous and nonferrous metallurgy, and the like. The value of standardization cannot be appreciated until it is applied to some activity and therefore I would urge that you recommend to your companies that copies of CSA published standards be made available to interested personnel in your respective plants. We will be glad to provide a list of standards on request.

Engineering Uses of ANALOG COMPUTING MACHINES

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THIS paper points out to engineers not familiar with computers how general-purpose analog computers fit into the over-all pattern of modern computing aids. This is done by brief, semitechnical descriptions of what these machines are and how they work; the kinds of problem that justify automatic computer treatment; and, within that category, the types of problem that should be handled by analog computers and those that should not.

INTRODUCTION

Many new forms of computing machinery, large and small, simple and complex, are being developed, built, and used currently. These are not mechanical brains in any but a very remote sense; they do not represent fundamentally new methods of attack on physical problems. They do represent remarkable developments of older mathematical aids, and they do enable the handling of many problems, solution of which formerly required more effort than could economically be expended.

This paper is primarily concerned with one of the two principal types of computing machines. This type was first given the name differential analyzer. Recently the terms analog computer and simulator have become more popular. All three names denote the same class of device. The term simulator will often be used here because of its appealing brevity and also because it is more truly descriptive of the manner of use of the devices.

The objective of this discussion is to provide for engineers not familiar with analog computers a concept of what these machines can do and how they are used. This will be done in five steps: First, the term analog computing machine will be defined; second, the operation principle will be described in brief; third, the major types of problem to which it is applicable will be listed; fourth, the manner of their application is described; and fifth, a discussion of limitations upon the applicability of such devices is presented.

WHAT IS AN ANALOG COMPUTING MACHINE?

As used in this paper, the term analog computing machine means a machine for determining the behavior of physical systems by the technique of simulation. For that definition to make sense, some of the words within it must be defined for this use. By physical systems we mean the assemblages of physical elements with which engineers work, such as mechanisms, electric circuits, chemical processes, heat processes, and the like. The mathematical statements of behavior of such systems take the form of differential equations, and the solutions are descriptions of the variation of one or more dependent variables as functions of one or more independent variables. The technique of simulation is the use of "models" for the various quantities of the problem system; these models behave mathematically in the same way as their counterparts of the problem system. The models are often completely dissimilar, except in the behavior sense, from the problem variables which they represent, and thus they are called analogs.

An analog computing machine, then, is a device which predicts the behavior of a physical system by the use of a mathematically equivalent artificial system behaving in a manner mathematically equivalent to the physical case. For every significant condition and feature of the problem there is an analog in the machine. Machine behavior then simulates problem system behavior; analog computers are thus often called simulators.

A great variety of analog computers have been invented, utilizing many different kinds of computing devices (7, 8, 9).[2] The bulk of these many computers are applications of specific model techniques to specific problems or restricted classes of problems (11, 12, 13). On the other hand, some of these machines utilize mathematical model techniques, and thus are applicable to any problem which can be stated in appropriate mathematical terms. These are called general-purpose analog computers, and they are the concern of this paper.

There is another large class of computing machines which is sharply different, and which will not be treated here. These are the digital computers, (10, 14) which are fundamentally machines which perform arithmetic operations on numbers. Familiar examples of this class are office adding and bookkeeping machines. Much more elaborate examples are the high-speed high-capacity programmed digital computers based on relay circuits or electronic trigger circuits. These are all arithmetic machines operating on quantities which change in discrete steps. The analog computers, with which we are primarily concerned in this paper, might be called calculus machines, working with continuously variable quantities.

Figs. 1, 2, and 3 illustrate some examples of analog computers for industrial use. Fig. 1 shows a mechanical differential analyzer (2, 3) in which all computing operations are performed in fundamentally mechanical fashion, and all analogs are shaft positions or rates. Fig. 2 shows an electronic analog computer (4), in which computing operations are performed by electronic circuits, and various voltages are the analogs of problem quantities. Fig. 3 is an electronic-mechanical analog computer, in which both mechanical and electronic operations and analogs are utilized.

Although there are general-purpose simulators of other kinds, these three examples represent the variety of such machines in two respects. As indicated in the preceding paragraph and in the photographs, they differ in basic design. They also vary in the related characteristics of size, cost, and capacity in terms of problem complexity. These differences will be illustrated further in the next two sections.

HOW DO THESE MACHINES WORK?

The basic mathematical operation which distinguishes these machines is integration. The primary variables of each prob-

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Contributed by the ASME Western Washington Section and the Hydraulic Division, and presented at the Spring Meeting, Seattle, Wash., March 24–26, 1952, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

[2] Numbers in parentheses refer to the Bibliography at end of the paper.

FIG. 1 THE DIFFERENTIAL ANALYZER, A MECHANICAL ANALOG COMPUTER

FIG. 2 AN ELECTRONIC ANALOG COMPUTER

lem are generated by the process of integration of quantities which represent the derivatives of these variables. The heart of each of these machines is, then, the integrator. Its precision, response, and reliability are important factors in machine quality (2, 5).

To be useful a simulator must be capable of other operations besides integration. If it is to have general utility, it must also have devices for addition and multiplication by a constant. With only these three kinds of elements, capable of integration, addition and multiplication by a constant, the machine is a linear analog computer, able to simulate linear systems, which means systems describable by ordinary linear differential equations.

All too frequently, researchers encounter cases which can't be treated realistically in terms of linear equations. For these it becomes desirable to have various simulator elements which generate trigonometric functions, simulate limit stops, obtain the product of two variables, inject an arbitrary function of a variable, and perform other nonlinear operations.

It is in differences in types and varieties of nonlinear function capabilities that the most significant differences in machines appear. The various sizes, costs, and complexity of the three example machines can be traced mainly to nonlinear function capacity. The limiter is the only type of nonlinear element incorporated in the small electronic machine shown in Fig. 2. This computer is very inexpensive. While it has astonishingly wide applicability, it is not as versatile as the mechanical simulator of Fig. 1. In that photograph one can see four input tables with sloping tops, arranged along the left side of the machine. These permit the injection of various continuous nonlinear functions, some obtained automatically and some manually. Other nonlinearities of the discontinuous type, such as backlash and stops, may be handled in the mechanical interconnection and transmission system of the machine (3). The electronic-mechanical simulator shown in Fig. 3 incorporates means for generation of trigonometric functions of variables in two different ways; devices for multiplication and division of variables; arbitrary function generators; "noise" or random signal generators; and other nonlinear capabilities, all operating automatically. These make it an extremely versatile simulator, and quite costly.

Thus, as in all things, various degrees of capacity can be obtained in simulators, with prices varying accordingly. Wise users of such computing aids examine their needs carefully before selection among the several different machines available.

WHAT CAN BE DONE WITH THESE ANALOG COMPUTERS?

There are various fashions in which the analog computer can be employed. The most important ways are the following:

1 *Simulation of a complete dynamic system.* Given a designed apparatus, the simulator answers the question of how it will perform.

2 *Experimental determination of parameters for optimum performance of complex dynamic systems.* Here the simulator provides an easy means of experimentation with gain factors, gear ratios, corrective networks, and the like.

3 *Simulation of part of a dynamic system,* the balance of which is incorporated in its true form. For example, one can "flight test" an actual airplane autopilot, using the analog computer to simulate the airplane dynamics.

FIG. 3 AN ELECTRONIC-MECHANICAL ANALOG COMPUTER (REMAC)

4 *Experimental synthesis of part or all of a dynamic system.* The design of a specific computer for a navigation system may be accomplished by simulating that system and inserting simulated specific computer designs.

5 *Training of operators in control of complex systems,* such as airplanes. The example under Item 3 might well be expanded to include automatic landing-system equipment and a pilot's cockpit. This would constitute a flight trainer which would be assembled and operated at a small fraction of actual flight training cost.

Keeping in mind the foregoing ways of using analog computers, we now proceed to consideration of classes of problems to which they are suited.

These machines are applicable predominantly to problems of dynamic systems, and in particular to dynamic systems in which the basic variable is time. Under this heading are many examples. The major subclasses to which analog computers have been applied in the past are considered in the following:

1 *Control Systems.* An already large and still rapidly expanding area of application of analog computers is in analysis and design of closed-cycle automatic control systems, or servomechanisms. Devices for controlling temperature in a great variety of industrial equipments; for controlling flow rate in chemical processes or in continuous liquid-fuel combustion equipment; for controlling concentration in chemical processes; for controlling tension in spinning and weaving equipment; and for controlling register in printing processes; these are but a few process applications of servomechanisms. Servos are employed in all automatic navigation equipment, such as ship steering mechanisms, airplane autopilots, and guided-missile control systems.

Whenever high performance is required of any of these servos, that is, whenever one of them is required to do work fast, then it becomes subject to such evils as instability and uncertainty of rate of response or character of response. In such cases, economical development of the equipment requires that these features be accounted for in the design stage. Before it is built, performance of a proposed design must be predicted.

Such analysis occasionally turns out to be performed easily by methods of classical mathematical analysis, or by use of modern operational mathematics. Much more commonly, however, if the mathematical statement of the system is at all realistic, solving the equations analytically would be far too time-consuming to be practical. Here the analog computer is right at home. The most common features which remove servo problems from the realm of linear mathematics—such features as limits, backlash, saturation, and static friction—are easily accounted for in simulator setups. All three of the machines shown in Figs. 1, 2, and 3 have been used extensively on problems of this category.

2 *Passive Oscillatory Systems.* This title is intended to denote the great variety of physical configurations, all of which are basically mass-spring-damping systems. Note that it includes not only mechanical cases, but also the many electric and hydraulic and aerodynamic and other cases describable by the same class of equations. Some specific examples in this category are spring suspensions for vehicle wheels; passive electric networks such as filters; aircraft control surfaces subject to flutter; compound pendula; shafts subject to torsional oscillation; and the infinite variety of vibration problems. Frequently in these cases, the same sort of "nonlinearities" as described herein under servos—limits, backlash, etc.—make manual solutions extremely laborious to obtain and sometimes unobtainable; while with analog computers they are easy. Again all three of the representative simulators shown in the photographs have been applied to such problems.

3 *Trajectory Calculations.* Under this heading come such problems as trajectories of ballistic missiles such as artillery shells; controlled missile trajectories such as the flight path of a glide bomb or other form of guided missile; and electron trajectories in vacuum-tube design. The mechanical differential analyzer of Fig. 1 has been applied to electron ballistic problems (3). Some problems in this category, particularly stellar ballistics, require high orders of precision. This removes them from the realm of analog computers. Where the answer must be known to five significant figures, it is a job for the digital computers, where precision of calculation is simply a matter of the machine capacity in number of decimal places. In controlled-missile trajectories, on the other hand, where the end result is not so drastically affected by small biases and scale errors, the limited precision of the analog machine is adequate. The electronic-mechanical machine of Fig. 3 was designed primarily for simulation of controlled-missile trajectories. It has been used for that and other problems as well.

The beauty of the simulator in such cases is the speed of obtaining solutions for different sets of conditions. Once the system has been set into the machine, a solution is produced in a matter of minutes or even seconds. A broad pattern of solutions representing many different combinations of conditions may be obtained in an hour or so.

HOW IS AN ANALOG COMPUTER APPLIED?

The four-step procedure for analog-computer operation will seem more than vaguely familiar because it is basically similar to the procedure for all engineering investigations. This procedure (4) is as follows:

1 *Diagram.* The importance of the diagram, a mechanical system sketch or a block diagram, as an aid to visualization and comprehension of a problem system cannot be overemphasized. In electrical applications, the block diagrams assume special importance if the lines are labeled with symbolic statements of what they represent; and the blocks labeled with similar statements of what happens in them. Borrowing from the terminology of the electrical people, we often call these line quantities "signals," and the block operations "transfer functions."

2 *Equations and Scale Factors.* The second step is the writing of the equations of the system and assignment of appropriate scale factors relating machine quantities to problem quantities. These operations are greatly facilitated by a carefully labeled diagram described in Item 1. Of course, it is far beyond the scope of this paper to discourse on differential or integral equations. It is, however, an interesting and significant fact that these modern computing aids, such as analog and digital computers, do not reduce the general need for mathematical talent. On the contrary, so many avenues of research activity are made suddenly profitable by the development of these machines, that mathematicians, scientists, and analytically minded engineers are still in demand.

3 *Setup of Machine.* In details this process will vary widely with the different types and designs of computer. In terms of the general-purpose simulator with which we are dealing here, the process is fundamentally one of assignment of integrators to generation of the variables; and connecting up the necessary computing chains, according to the equations, to feed the integrators.

This step in simulator use can become a time-consuming one. It is not so in such a machine as the one shown in Fig. 2. After writing scaled equations for that machine, set up requires only plugging in wires and setting dials. But where machine set up involves extensive mechanical hookup, see Fig. 4, the set up is the costly part. Aligning, orienting, and coupling

FIG. 4 ALIGNING THE ELECTRONIC AND MECHANICAL SECTIONS OF THE BEMAC

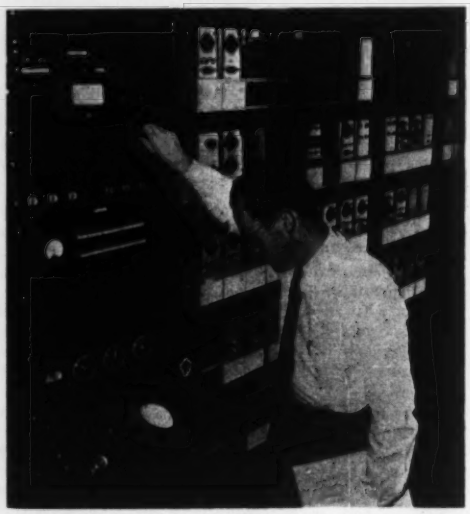

FIG. 5 ADJUSTING THE VIEWING OSCILLOSCOPE OF THE BEMAC—THE CAMERA OSCILLOSCOPE IS IN BACK OF THE RACK SHOWN

gears and shafts can never proceed with the speed of plugging in wires.

4 *Operation of Machine.* Once the setup has been achieved, operation of the machine requires merely that the independent variable, or variables, start changing. In practically all commercial analog computers, the machine independent variable is time. Operation is then "starting time," which means making final application of power so that the integrators begin integrating. This requires but the flip of a switch, and in a few seconds or minutes a solution will have been presented. Solutions appear usually on the screen of a cathode-ray oscilloscope, as shown in Fig. 5, or some form of oscillograph such as the one at the extreme right in Fig. 8, or on a plotting table.

Figs. 6, 7, and 8 illustrate, by means of a sample problem, the use of the electronic simulator of Fig. 2. This problem demonstrates the four-step procedure just described. It is a small problem when viewed from the standpoint of analog-computer use. The complete machine treatment for that example would require only about two man-hours. Were it necessary to handle that case by purely analytical means, time of the order of man-weeks would be needed.

WHY NOT USE THESE MACHINES FOR ALL PROBLEMS?

There are two basic reasons for restriction of use of these machines to certain classes of problems. First, there are many problems which do not justify treatment by such elaborate means. Second, the fundamental nature of the simulator rules out its use for two classes of problem which do justify machine application.

Just as one does not seek a desk calculating machine to perform the multiplication of five times eleven, it is clear that a simulator is not justified for solution of a single second-order linear differential equation. In general, use of the analog computer is indicated where handling of the problem entirely by mathematicians becomes unduly laborious. The mathematical features which usually cause such solutions to be "unduly laborious" are a large number of simultaneous equa-

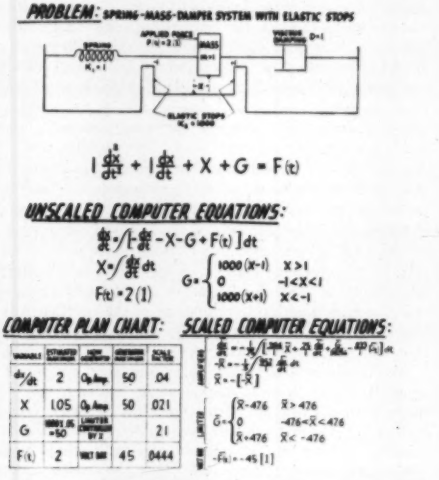
PROBLEM: SPRING-MASS-DAMPER SYSTEM WITH ELASTIC STOPS
SPRING
APPLIED FORCE
MASS
VISCOUS DAMPING
ELASTIC STOPS
$I\frac{d^2x}{dt^2} + I\frac{dx}{dt} + X + G = F(t)$
UNSCALED COMPUTER EQUATIONS:
$\frac{d^2x}{dt^2} = \int [I\frac{d^2x}{dt^2} - X - G + F(t)]\,dt$
$X = \int \frac{dx}{dt}\,dt$
$F(t) = 2(1)$
$G = \begin{cases} 1000(X-1) & X > 1 \\ 0 & -1 < X < 1 \\ 1000(X+1) & X < -1 \end{cases}$
COMPUTER PLAN CHART:
SCALED COMPUTER EQUATIONS:
$\frac{d\bar{x}}{d\tau} = -\frac{1}{.394}[.394\,\bar{x} + .25\,\frac{d\bar{x}}{d\tau} + \frac{1}{.952}\,\bar{G}]\,d\tau$
$\bar{x} = \frac{1}{.952}\int \frac{d\bar{x}}{d\tau}\,d\tau$
$\bar{x} = -[-\bar{x}]$
$\bar{G} = \begin{cases} \bar{x} - .476 & \bar{x} > .476 \\ 0 & -.476 = \bar{x} < .476 \\ \bar{x} + .476 & \bar{x} < -.476 \end{cases}$
$-\bar{F}(\tau) = -.45\,[1]$
dx/dt 2 Op Amp 50 .04
X 1.05 Op Amp 50 .021
G LIMITER 21
F(t) 2 VOLT BOX 45 .0444

FIG. 6 SAMPLE PROBLEM FOR ELECTRONIC SIMULATOR; CHART SHOWING DIAGRAM AND EQUATIONS

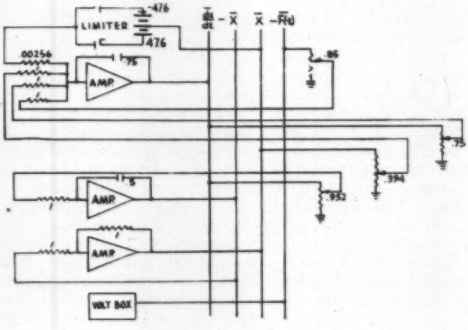

FIG. 7 SAMPLE PROBLEM; CONNECTION DIAGRAM

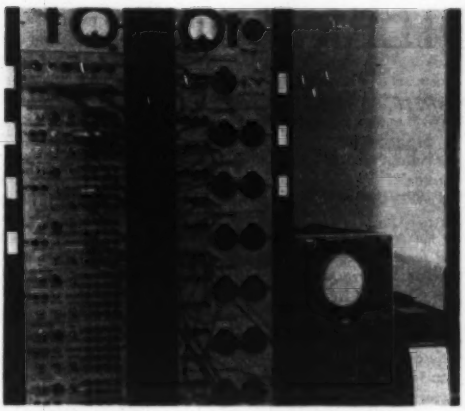

FIG. 8 SAMPLE PROBLEM; COMPLETE SIMULATOR SETUP

tions and nonlinearities. That description of the division line between the groups of problems which do and do not require simulator aid is quite unspecific. It must remain so because of the variety of machines; it must always be a matter requiring engineering judgment. The rather long set-up time of simulators such as those shown in Figs. 1 and 3 make it usually uneconomical to use such a machine for small problems. The electronic machine of Fig. 2, on the other hand, is frequently set up for a problem of average complexity in less than five man-hours. The latter type of machine, by virtue of that feature and also its low first cost, should be employed for far simpler problems, even including many which the mathematicians now solve with their desk calculators.

The characteristics which place a lower limit of complexity of problems to which any given machine should be applied are the following: (1) Initial cost of the machine, (2) set-up time, and (3) time required for analysis of results.

The third consideration, not heretofore mentioned, enters as a consequence of the character of the solutions presented by these machines. The oscillographic or plotting table (1) picture displayed is such as to require interpretation to make it quantitative and fully meaningful. To men employing such indication means habitually, this interpretation process becomes practically unconscious and very rapid. Still, to make the answers fully numerical and of form suitable for reporting some time must be spent upon the solution records. This time, and the usually much greater set-up and check-out time, constitute the principal operating costs of the simulator.

We have said that the fundamental nature of the simulator restricts its use within the realm of problems justifying large-scale computer application. This shows up in two ways: First, the fact that it is a calculus machine utilizing continuously varying quantities within itself makes it inappropriate to basically arithmetic problems. Examples of such cases are census calculations, other statistical problems, cost accounting, banking, inventory, time-study calculations. These are problems in numbers, for which digital machines should be used.

The second natural restriction is the precision limitation. This arises in part from limitations in the individual computing devices—drift in integrators is a common example—and in part from the task of measurement of these continuously varying quantities within the machine. These conditions result in an over-all machine precision limitation to generally two or three significant figures. It will be observed that very few dynamic problems are excluded by this limitation. In many of the investigations of dynamic systems, numerical answers are not what is desired at all. In such cases, the information needed is the presence or absence of instability in the system, and perhaps design of devices needed to prevent such instability.

CONCLUSIONS

Analog computing machines are readily available devices for the solution of problems in the behavior of those dynamic systems in which a solution with engineering accuracy is adequate. This specification encompasses a large class of important engineering problems. Simulators of varied cost and capacity are available for use on problems of proportional difficulty. For complex dynamic systems which result in unmanageable mathematical statements, there are machines of appropriate capabilities. Smaller general-purpose simulators, especially the electronic type, are sufficiently low in first cost and rapid in set up so that their use is justified in virtually all problems of simpler dynamic systems, even those which can practically be handled by mathematicians. The intelligent use of machines such as these enables the present-day engineer economically to meet the challenge of increasing complexity of problems in design of dynamic systems.

ACKNOWLEDGMENTS

The photograph, Fig. 1, was reproduced through the courtesy of the General Electric Company and Figs. 2 through 8 through the courtesy of the Boeing Airplane Company.

The author wishes to acknowledge also the welcome criticism and suggestions of Boeing engineers too numerous to be listed here. Particularly great contributions were made by Walter J. Frantz, who has worked hard and successfully to extend the scope and effectiveness of computer applications in industry.

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THE ASME BOILER CODE

II—ASME Sets Up Boiler Code Committee and Adopts Code of 1914

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THE state laws of 1909 and 1911 setting up rules for the construction and operation of steam boilers in Massachusetts and Ohio were excellent in their requirements, yet because they bore evidence of the peculiar bias of the formulators they lacked the appeal which would lead to adoption by other state boards. As a result neither of these laws could furnish the uniform requirements needed for the whole country. Uniform rules would eliminate the added cost of large inventories for the builders who must stock materials and attachments to suit different state specifications. They would also make possible the mass production of a type or size of boiler in demand in many states; and even off-demand manufacture for stock could be practiced. By 1911 the various state laws relating to inspection differed widely and many of them required inspection by men licensed for this purpose by the state in which the boiler was to be installed. Some inspectors carried license certificates from many states to care for the inspection in one district or even one shop. A boiler built in one state and approved by an inspector of that state could not be installed in some other state because of the law, even though the inspector had been licensed after a searching examination and had years of experience.

ASME COMMITTEE APPOINTED

Col. E. D. Meier, president of the Heine Boiler Company, was elected President of The American Society of Mechanical Engineers for the year 1911. It will be recalled that in 1898 he had endeavored to have The American Boiler Manufacturers Association approve a uniform set of rules for the construction of steam boilers but without success. This matter was still in his mind in 1911. At that time he resided in New York City, his company having its office there, and at intervals he discussed the preparation of a code by the ASME with his friend William H. Boehm, vice-president of the Fidelity and Casualty Company of New York, through whom he had insured the boilers of the Heine Boiler Company. Colonel Meier believed that a set of rules formulated by ASME, with its reputation and broad scientific interests which made it commercially disinterested, might be approved and adopted by all the states as a basis for their laws. Such rules would eliminate the unnecessary and even improper differences between the state and municipal laws of that day. On Sept. 15, 1911, after a number of these discussions, he asked the Council of The American Society of Mechanical Engineers to approve appointment of a committee to formulate standard specifications for the construction of steam boilers and other pressure vessels.

This meeting of the Council was attended by E. D. Meier, Charles Whiting Baker, Robert M. Dixon, Stanley G. Flagg, Jr., H. L. Gantt, E. M. Herr, Alex. C. Humphreys, I. E. Moultrop, H. G. Stott, H. H. Vaughan, William H. Wiley, and Calvin W. Rice. Minute 159 reads: "Voted to confirm the appointment of a committee to formulate standard specification for the construction of steam boilers and other pressure vessels and for the care of the same in service to consist of John A. Stevens, chairman; E. F. Miller, C. L. Huston, H. C. Meinholtz, Richard Hammond, R. C. Carpenter, and W. H. Boehm."

As in the appointments for the board of the Massachusetts rules, the members of the committee were chosen to represent different interests. Mr. Stevens was a consulting engineer using boilers; Messrs. Meinholtz and Hammond, boiler manufacturers; Mr. Huston, a steel manufacturer; Messrs. Miller and Carpenter, engineering educators representing users; and Mr. Boehm, an insurance engineer.

The Committee first met in New York City and at Ithaca, N. Y., in 1912 for its second meeting. Succeeding meetings were held in New York City.

THE PRELIMINARY REPORTS

After a study of the Massachusetts rules and the later equivalent, the Ohio rules, at these many meetings, the Committee, with C. W. Obert as secretary, made its preliminary report in 1913 and sent some 2000 copies to professors of mechanical engineering, superintendents of inspection departments of insurance companies, chief inspectors in charge of national, state, and municipal boiler-inspection departments, engineers known to be interested in the construction and operation of steam boilers, manufacturers of steam boilers, and editors of engineering journals, for study and criticism, with a request for suggestions of changes or additions.

This report, where not verbatim, was essentially the same in order and form as the Massachusetts law with its Engineers' and Firemens' License Law, the Boiler Inspection Law, Parts 1, 2, and 3 of the Rules for Construction and Installation of Steam Boilers to which the words "and Other Pressure Vessels" were added. It also contained the Rules for Operation and Care of Steam Boilers, Recommendations by the Committee, and the Appendix for design of boilers, furnaces, and tubes.

The principal differences between the first preliminary report and the Massachusetts law were: the substitution of the words "State of —" or "City of —" for the "Commonwealth of Massachusetts;" the reduction of allowable pressure of 25 psi to 15 psi for cast-iron heating boilers and 160 psi to 125 psi for boilers with cast-iron headers; steel specifications of a special committee in place of ASTM steels; and the inclusion of more than 133 pages of tables of efficiency of different types of riveted joints with different pitches, thicknesses of plates, and diameters of rivets. The full report of laws, rules, tables, and appendixes covered only 230 pages.

The Committee then prepared a new preliminary report in which it was stated that many replies to their request for comments on the original report had been received and all criticisms and suggestions had been tabulated and given thorough consideration. This second report, dated Feb. 18, 1914, was entitled Preliminary Report, although called the "final report" in the acknowledgment on page 2. Colonel Meier, then a past-president of ASME and a boiler manufacturer, was appointed a member of the Committee on Jan. 6, 1914, to the vacancy caused by the death of Mr. Meinholtz on Dec. 24, 1913.

Second chapter of a history of the ASME Boiler Code prepared for the Boiler Code Committee of The American Society of Mechanical Engineers. Chapter 1, which dealt with the antecedents of the Code, appeared in MECHANICAL ENGINEERING, July, 1952, pp. 555-562.

COMPARISON OF FIRST AND SECOND PRELIMINARY REPORTS

As one compares the first and second reports it is found that there are not many changes, indicating that either few suggested changes were of value, or if of value, few were used. The words "other pressure vessels" had been added where necessary and where "Commonwealth" had been copied from the Massachusetts law by oversight, this was changed to "State" or "City," and "Board of Boiler Rules" from the model was altered to "Committee of the ASME." The order of the appendixes was changed, and the recommendations which now appeared as Appendix 2 had the words "not compulsory" beneath the title.

Some new matter or changes in the second printing not found in the first were: The requirement of the posting of rules for operators in the boiler room, occurring in the inspection law; some alterations in the headings of the rules; and the substitution of ASME material for material proposed by a special committee. The section on materials was altered in a number of ways. In the operating rules, those relating to air-receiving tanks and elevator pressure tanks were new.

Over two thousand copies of this second printing of Feb. 18, 1914, with personal registration numbers on each, were sent to engineers, engineering and industrial organizations, and editors accompanied by the following letter of April 6, 1914:

We are sending you enclosed, the Preliminary Report of the Committee to Formulate Standard Specifications for the Construction of Steam Boilers and other Pressure Vessels and for Care of Same in Service and especially invite you to cut out what you do not consider advisable to incorporate in the final copy of the Report and also to add to our work, whatever will, in your judgment, further safeguard human life and property. We would especially mention and earnestly request that your suggestions be typewritten, referring to the pages where the changes should be made, since there will be some 2500 requests similar to this one, sent throughout the civilized world, both to members and nonmembers of this Society, to prominent steel manufacturers, boiler manufacturers, insurance companies, boiler users, consulting engineers and operating engineers; in fact, all those interested in the art and all those who have been declared or are known to have special knowledge of the boiler business.

It will be inferred that no criticism from you means that you approve the publication of the pamphlet substantially as sent you with the additions which may come from conference with the members of our mailing list.

We would further request that your suggestions be submitted to The American Society of Mechanical Engineers addressed to this Committee inside of sixty days from the receipt of same, since we wish to be ready for discussion at the Spring Meeting, which is to be held in June 1914, at St. Paul-Minneapolis, Minn.

Our idea is, that after we have received the suggestions from the members of our international mailing list, to rearrange and properly index the entire report.

The basic idea of this Committee's work is to formulate a standard "par excellence" for those who desire to have the best boilers and pressure vessels known and to put an end to the killing of so many men in the United States of America, by boiler explosions and derangements, which might be prevented, also to create a standard which we hope will be ultimately adopted by the Federal Government and by other Governments not now having boiler regulations. We hope to secure through uniform legislation, by the various states of our own country, such a condition of affairs that a boiler built for any State will be acceptable in any other State.

We might mention that in six years, over 8300 boilers were constructed to the Massachusetts Standard, which forms the basis of the pamphlet referred to, and since putting such laws into force in Massachusetts, boiler explosions and derangements have been reduced to a minimum.

Further, the work of the Committee is intended to be educational; we find that all well-disposed interests are in favor of the best material and construction known, when it comes to boilers and other pressure vessels, which are so dangerous to human life and property.

We would here call attention to the fact that Germany has a set of rules even more drastic than the ones proposed by the Committee.

The foundation of these rules has been for some time enforced by the laws of Massachusetts, and has been more recently adopted by the State of Ohio, the City of Detroit, and the City of Manila of the Philippine Islands. Several other States in the United States are now considering the adoption of standard rules regulating boilers and other pressure vessels.

You will observe that we are trying to give everyone qualified an opportunity to present his opinions, so that the rules may represent the best judgment of a majority of the qualified engineers of the world.

We would also state that recommendations which further protect life and property will be filed in the archives of The American Society of Mechanical Engineers against the name of anyone who suggests the same, in the spirit of "credit where credit is due."

Trusting that you will receive the entire work of this Committee in the spirit in which it has been so far carried on, we are, Sir,

Yours truly,

JOHN A. STEVENS, *Chairman*
WILLIAM H. BOEHM
ROLLA C. CARPENTER
RICHARD HAMMOND
CHARLES L. HUTTON
E. D. MEIER
EDWARD F. MILLER
Committee to Formulate Standard Specifications for the Construction of Steam Boilers and Other Pressure Vessels, and for Care of Same in Service.

Mr. Meinholtz formerly a member of this committee was very active in the preparation of this work up to the time of his death, Dec. 24, 1913.

OPPOSITION ENDANGERS THE CODE

This letter brought a storm of protest from different organizations by the time of discussion at the Spring Meeting of the Society at St. Paul-Minneapolis on June 17, 1914, as stated in the letter just quoted. On Monday, June 15, 1914, a preliminary meeting of the Committee with representatives of the Association of Steel Manufacturers and the Association of Tubular Boiler Manufacturers was held in Chicago for the discussion of the specifications for steel, and this discussion was continued at the ASME Spring Meeting, Wednesday, June 17.

For some time after the Committee was formed there were signs of dissatisfaction from members of the Society who were opposed to rules governing their business. Some of these wished to prevent any final action at the 1914 Spring Meeting and evidently sowed seeds of distrust in the minds of the Council. This may have been due to the assertiveness and persistence of the chairman of the Committee, John A. Stevens. The minutes of the Council for June 16, 1914, preceding the meeting of the June 17 record: "Protests from members of the Society and prominent railroad officials were presented, to the effect that the consideration of the Boiler Code be not brought up at the Annual Meeting until after a conference could be held with the above representatives; and the Council voted: That following the usual practice of the Society, final publication of the Code will not be made but a topical discussion for the benefit of the Committee in the preparation of the Code shall be held as announced in the program."

It is learned from *The Journal* for July, 1914, that Wednesday's "overshadowing event was the discussion upon the subject of Boiler Specifications." The tentative draft had been printed so that the Committee's work might be checked and revised before submitting the report for general discussion. The discussion at this Spring Meeting was participated in by individuals and representatives of organizations as well as representatives of one boiler company which objected to the limit of 125 psi on boilers with cast-iron headers.

Dr. D. S. Jacobus reports that during this meeting of the Society an attempt was made to remove John A. Stevens from the chairmanship of the Committee and that Henry Hess, member of the Council, severely criticized the Preliminary Report and asserted that the Committee should co-operate

with industry and that he favored a reconstruction of the Committee, discarding what had been done and starting over again. He praised the Society for its grand work in the past and stated that the membership of the Society in their loyalty should maintain its high standard. Dr. Jacobus then pointed out to the meeting of the Society that Mr. Stevens had been very successful in his work in formulating the Massachusetts Boiler Rules and he was sure that the present Committee would be glad to follow the suggestions of co-operation with industry as made by Mr. Hess. He called attention to the vital interest in the work of the Committee of Past-President E. D. Meier, a member of the present Committee, who felt that the formation of the Boiler Code Committee (which he originated as President) was his greatest contribution toward the welfare of society. The abandonment of this preliminary work would be a great blow to him at this time of his illness and his disappointment would be greatly regretted by his many friends in the Society and in the boiler industry.

No further action on this matter was taken and Mr. Hess became interested in the continuation of the Committee and its effective work. The discussion of the report not only used all of the assigned time but was carried on during the remainder of the day in another room. A resolution was passed which called for a public hearing to be held on Sept. 15, 1914, and stated that interested persons should submit their criticisms and suggestions in writing before August 15. Another resolution called for a notification of the meeting to be made in the technical press as well as by invitation. Representatives from a list of 37 organizations of engineers, manufacturers, national, state, and municipal inspection bureaus, and of boiler rules, were to be invited to participate in the proposed hearing.

THE PUBLIC HEARINGS OF SEPTEMBER, 1914

The conference at the Engineering Societies Building in New York on Sept. 15, 1914, opened with 150 present. The meeting was called to order by the chairman of the Committee, John A. Stevens. A spirit of co-operation was evident in all of those present. Besides the engineers who attended as individuals, there were representatives of steel manufacturers, boiler-tube makers, railroads, agriculture boiler makers, the American Society of Heating and Ventilating Engineers, and the American Society for Testing Materials.

In opening the meeting, Mr. Stevens drew attention to the large number of boiler failures and the fatalities and losses associated with them and forcibly expressed the necessity for better boilers and better conditions governing operation to eliminate those failures by the introduction of uniform boiler laws. The Committee, he said, believed that not only the manufacturers but also the users desired some freedom from annoyances resulting from lack of uniformity in state laws. He stated that it was the policy and desire of the Committee to receive and consider any and all suggestions for the Code that would make for greater protection of human life and property. The meeting was then addressed by representatives of manufacturers, users, and designers as well as the secretary of the American Society for Testing Materials.

The meeting first considered methods of procedure in order to satisfy all inquirers and to give everyone interested an opportunity to be heard. It was decided to consider written discussion first and it was subsequently ruled that another public hearing should be held if necessary and also that the Committee would confer with any interested body to give that body opportunity to discuss and consider any question in the Committee report.

After the noon recess the discussion of the Code was taken up seriatim, beginning at page 1 and including the written discussions which had been received concerning the page in question. The laws were discussed by users, operators, and insurance companies. Parts 1 and 2 were then considered. Some sections such as those on boiler ratings, shearing strength of rivets, factors of safety, length of life of lap-seam boilers, fusible plugs, bracing of heads, and safety valves were discussed. This latter subject occupied so much time that it had to be discontinued to hear from the National Association of Thresher Manufacturers on the type of boiler they favored. A committee of the American Society of Heating and Ventilating Engineers discussed the report and a general discussion on boiler materials was carried on without adjournment until 8:30 p.m.

The session on the second day, September 16, was devoted to a series of conferences to determine specific requirement of industries affected by the Code, such as the manufacture of tubes, boilers, and steel. At this meeting plans were made for the formation of a permanent organization for the introduction of the Code into the legislatures of various states.

At an adjourned meeting on September 29, a satisfactory specification for tubes was presented by the tube manufacturers, and a representative of the Master Steam and Hot Water Fitters appeared to urge the acceptance of the changes recommended by the National Boiler and Radiator Manufacturers Association. Representatives of the railroad association and the safety-valve manufacturers conferred with the Committee and agreed to formulate specific recommendation at a later date.

At the end of the hearing the Association of American Steel Manufacturers, the American Boiler Manufacturers Association, National Tubular Boiler Manufacturers Association, the National Association of Thresher Manufacturers, and the Boiler Code Committee agreed upon the grades of boiler material to be used, and later the Boiler Tube Manufacturers of America submitted a uniform specification for boiler tubes. Practically all of the makers of safety valves, for the first time in their history, agreed upon a uniform specification for their product which would be the best for public safety.

The railroad interests of America presented a most splendid criticism of the preliminary report which helped greatly in bringing about the actual success of the hearing.

THIRD PRINTING OF THE PRELIMINARY REPORT

Following the hearing the Committee used the suggestions and agreements with the groups to prepare the proof of the third printing of the preliminary report so that it could be sent out to interested parties with a letter of Nov. 5, 1914, from the Secretary of the Society, Calvin W. Rice, requesting that suggestions for changes or additions be sent in by November 12, so that this report might be presented to the ASME Council at its meeting on Friday, Nov. 13, 1914.

The third printing showed many changes in and additions to the suggested laws and the rules. The words "other pressure vessels," were omitted from the title and the paragraphs in each of the three parts of the rules were numbered consecutively instead of starting each of the small sections at paragraph 1. The maximum pressure on boilers with cast or malleable headers or cast-iron mud drums were restored to 160 psi from the 125-psi maximum and a new paragraph permitting 30 psi on hot-water heating boilers when the temperature was less than 212 F, or if special tests were made with such heaters, when the temperature was above 212 F. The sizes of headers were limited, and tests, method of casting, and properties of materials of construction were designated. The safety-valve paragraphs were rewritten and many additions were made. There were no changes in the numerous tables of efficiencies of joints. The material specifications were new and followed the ASTM specifications except those for tubes which had been adopted by the Boiler Tube Manufacturers of America. The rules for stamping, ligaments, staying, riveting, tubes, open-

ings, manholes, valves, piping, and nonstandard and portable boilers were almost unchanged, while the paragraph on factor of safety for boilers in service at the time of approval of the Code was rewritten. Few changes were made in the four appendixes on rules for operation, suggestions, and formulas.

While the Boiler Code Committee was working on the third printing of its report involving the changes suggested in September, the ASME Council had a meeting on Oct. 9, 1914, at which the general subject of the Boiler Code was opened for discussion. Isaac Harter, Jr., of the Boiler Manufacturers and F. H. Clark of the ASME Subcommittee on Railroads were present to speak on the need of a code. Following the discussion a resolution prepared by a Committee consisting of Past-President Alex. C. Humphreys, E. B. Katte, and I. E. Moultrop was passed as follows: "Resolved, That the Boiler Code Committee be requested to prepare a reprint of their preliminary report and give all other committees of this and other societies with whom they have conferred full opportunity to concur therewith or submit objections thereto. The Boiler Code Committee having considered all suggestions so submitted are requested to then report to the Council for further action." The Council further recommended that title page of the preliminary report be somewhat shorter than that previously used.

The minutes of the meeting of the Council of the Society on Nov. 13, 1914, contain the following items on the Boiler Code:

Item 598—Voted to rescind the parts of the action of the Council limiting it to steam boilers in Item 572.

Item 609—Voted that the reports of Committees involving many different interests be referred to the Council in the same way and for the same reasons as carried out in the report of the Boiler Code Committee.

Item 610—The Council invited members of the Boiler Code Committee with Dr. D. S. Jacobus to represent them—and Mr. F. H. Clark representing the Subcommittee (of the Society) on Railways for discussion of report. After complete consideration it was: Voted that the Code of the Boiler Code Committee be reprinted after the corrections have been received by the Committee, and the Committee is requested to present the same as a progress report at the annual meeting of the Society. The Committee is requested to omit from the report the forms of law, license certificate, and efficiency tables.

Following this Council meeting, the fourth printing of the Code, called a progress report, was immediately prepared for presentation at the Annual Meeting of the Society in December, 1914, as instructed by the Council. This was sent to members of the Committee, to representatives of the conferring organizations, and also to every member of the Society in time for examination and study prior to the meeting on Dec. 1, 1914. It also was to be published in Volume 36 of the Transactions of the Society, although at the time of the printing of this volume the final Code had been adopted and it was published in the place of the progress report.

"INTRODUCTION" TO THE REPORTS

Each printing of the report contained on the first pages of text an "acknowledgment" giving reasons for the Code, methods of formulation, and acknowledgments to those who had aided in the work. These varied slightly in different printings, but because the one appearing in the Progress Report (fourth printing) gives such information, it is quoted herewith.

INTRODUCTORY

Every year there averages in the United States between 1300 and 1400 serious boiler accidents, of which 300 to 400 are violent explosions. These accidents kill between 400 and 500 persons, injure 700 to 800 more, and destroy more than a half-million-dollars worth of property. In a single explosion, that of the R. B. Grover Shoe Company at Brockton, Mass., 58 persons were killed, 117 more were injured, $250,000 worth of property was destroyed, and an aggregate of $280,000 was claimed in the personal injury and death suits that were brought.

These disasters emphasize: the necessity of constructing and installing steam vessels and their appurtenances in as nearly perfect a manner as possible; the importance of preventing carelessness in their operation; and the wisdom of having them inspected at regular intervals by disinterested experts.

At the present time ten states and nineteen municipalities have in force laws for the compulsory inspection of steam boilers in which are comprised a code of practical rules for their construction and operation; and a number of other states and municipalities have prepared or are now preparing similar laws for enactment. The laws now in force all differ from one another in a number of material respects, and unless some relief can be obtained each new law as enacted will differ from all the others.

By reason of the differences in their laws, a boiler built in one state having such a law may not be shipped into another state having such a law—not because the boiler is any less safe in one state than in another—but solely because it does not meet the requirements of construction in both states. Worse than this, a state which has no such law becomes a common dumping ground for all the old worn-out and unsafe boilers that are condemned and put out of service by the states that have such laws.

On account of this lack of uniformity in these laws intolerable confusion has resulted. It is a practical impossibility for boiler manufacturers to comply with all of the various rules of construction embodied in so many different state laws. This condition seriously affects virtually every manufacturing interest in the United States. It affects every purchaser of a steam boiler because it increases in an unnecessary and unwarranted manner the cost of boiler construction; it affects all manufacturers of boiler material because boiler plate and other material cannot be made to uniform specifications; and it affects the makers of boiler fittings and safety appliances because they cannot be standardized.

The urgent need, therefore, of uniform laws for the construction and safe operation of boilers is apparent.

In order to make it possible for each state in the United States to adopt identical laws, not only for the construction and operation of boilers, but for examining and licensing engineers, The American Society of Mechanical Engineers, during the presidency and at the suggestion of E. D. Meier, appointed a committee consisting of seven members as follows: A consulting engineer, former member of the Massachusetts Board of Boiler Rules, and two professors of engineering representing the steam users' interests; two boiler manufacturers representing the boiler makers' interests; a steel manufacturer representing the boiler-material interests; and an insurance engineer representing the interests of the boiler insuring companies. The Committee used as a basis for discussion the rules that have for several years worked so satisfactorily in practice in the states of Massachusetts and Ohio, and which were acknowledged by all interests to be the best rules then in existence. Numerous meetings of the Committee were held during which these rules were deliberated upon and then modified or added to in accordance with the Committee's best judgment. The Committee then prepared a first preliminary draft of the rules for construction, some 2000 copies or more of which were sent to professors of engineering in technical schools, superintendents of inspection departments of insurance companies, chief inspectors in charge of United States, state, and municipal boiler-inspection departments, prominent engineers known to be interested in the construction and operation of steam boilers, prominent manufacturers of steam boilers, and editors of prominent engineering journals. A letter was sent with each copy requesting the recipient to carefully read the preliminary report and then to give the Committee the benefit of any criticisms or suggestions he had to offer. All replies were given careful consideration, and at the Spring Meeting of the Society held in St. Paul, Minn., on June 16 to 19, 1914, it was decided to invite all interests affected to appear at public hearings to be held in the Engineering Societies Building in New York, beginning September 15, 1914. These hearings were the means of bringing together representatives of the steel manufacturers, of the railways, of the boiler manufacturers, of the American Society for Testing Materials, of the Heating and Ventilating Engineers, of the National Association of Stationary Engineers, and of other associations and interests. These hearings developed into one of the most important movements ever undertaken for the protection of human life and property.

It is especially worthy of mention that at these hearings uniform specifications for boiler steel and other material were agreed upon; uniform specifications for boiler tubes were agreed upon; uniform rules for safety

valves were agreed upon; uniform rules for fire-tube boilers were agreed upon; uniform rules for water-tube boilers were agreed upon; and uniform rules for steam and hot water heating boilers were agreed upon.

It may be noted that the factors of safety recommended for stationary boilers are somewhat higher than those required by the government for railway locomotive boilers. This is in no sense a criticism of the requirements of the Interstate Commerce Commission, but is based upon the judgment of the Committee, that a higher factor should be used for stationary boilers—first, because not every stationary boiler is built in a modern shop under careful engineering supervision; second, because not every stationary boiler is in charge of an operator so skilled as a thoroughly experienced locomotive engineer; third, because stationary boilers are so bricked in and so constructed that their condition cannot so readily be determined; and finally, because locomotive boilers are required by law to be inspected not less than once a month. For these reasons the Committee is of the opinion that while a factor of safety of four affords ample protection for railway locomotive boilers a higher factor of safety is required for stationary boilers.

ACKNOWLEDGMENTS

As lack of space makes it obviously impossible to offer acknowledgments to all sources from which information has been obtained, the Committee desires here to express its grateful appreciation to everyone who has in any way helped in the preparation of this report. It is hoped that by the universal adoption of this proposed Code better and safer boilers will be produced, and the Committee trusts that the saving of human life which should be brought about by the adoption of these standards will in itself more than repay all who have given of their knowledge and experience to this work.

JOHN A. STEVENS, *Chairman*
WM. H. BOEHM
ROLLA C. CARPENTER
RICHARD HAMMOND
CHAS. L. HUSTON
E. D. MEIER
EDWARD F. MILLER

Committee to Formulate Standard Specifications for the Construction of Steam Boilers and Other Pressure Vessels and for Their Care in Service.

This printing, which retained the words "other pressure vessels" in the title, was reduced to 116 pages and contained: Part 1, rules applying to all boilers then or thereafter installed; Part 2, rules applying with the rules of Part 1 to boilers installed after a certain date; and then later sections on air pressure vessels, rules for operation and care of boilers and other pressure vessels, recommendations, and finally a series of formulas for stays, flat heads, combustion chambers, tube sheets, furnaces, and tubes.

It was made up of the parts of the third printing which had received approval by the suggestions and action of the interested parties at the September, 1914, hearing or had been approved and suggested by those who had sent in criticisms of that printing which had been issued on Nov. 5, 1914, for written comments as directed by the ASME Council on Nov. 13, 1914. In it the paragraphs up to and including those on air pressure vessels were numbered consecutively from 1 to 246.

DISCUSSION OF THE PROGRESS REPORT, DECEMBER, 1914

The Progress Report was brought up in open meeting at the business session of the Society on Wednesday morning Dec. 2, 1914, by the chairman, John A. Stevens. He spoke briefly of the need for a Boiler Code and outlined the development of the report and the methods that had been used to secure suggestions, criticism, and agreement. He also pointed out that further suggestions and criticisms were welcome and urged submission of such at the meeting, so that through co-operation the final production of the Code which was so urgently needed would be assured.

The President of the Society ruled that consideration should be given to the details of the Construction Code only, and that each subject and paragraph be taken up serially whenever discussion might be offered. This ruling brought objections from some members, and the President entertained a discussion of the general consideration of the report as a whole. There was some unfavorable criticism as to the method of procedure of the Committee and the inclusion of legislative matters. The great majority of the speakers, however, favored the general plan of the Code and commended the Committee for its work. Others who were not in sympathy with the purpose of the Code spoke on its effects upon the boiler industry and its advisability and desirability. Finally, a strong attempt was made to bring a motion before the meeting that would test out the advisability of continuing the Committee's work. The motion on discontinuance was curbed by many amendments and finally delayed by adjournment for the noon recess.

The meeting reconvened at 2 p.m. with H. G. Stott, vice-president ASME, presiding. The motion made before the adjournment was withdrawn and the consideration of the report by paragraphs was carried out as first suggested, beginning at Par. 1. Careful attention was given to each paragraph. The criticism varied from points of punctuation and grammatical arrangement to questions of correctness of rules, consistency of requirements, and other significant engineering statements. For instance, the safety-valve Pars. 19 to 43, inclusive, which had been approved by the manufacturers and were thought to be a great advance over past practices, were criticized by users and inspectors as too cumbersome and complicated; it was stated that the basing of the size of valve on the fuel used would lead to different sizes for different states. Criticism was so great that the matter was referred to a safety-valve conference.

The remainder of Part 1 was passed with some discussion on fusible plugs. Consideration of the validity of the details of efficiency was postponed until another session, and the second session concluded with discussion of Pars. 84 and 85 relating to forge-welded joints for which a slight modification in wording was suggested.

The third session on Wednesday evening was concerned with the general discussion of material specifications comprising Pars. 1 to 112 of Part 2 and the advisability of having them agree with ASTM specifications. It was noted that specifications for iron rivets, stay-bolt steel, and bar iron and steel were missing; this omission was referred to a committee representing steelmakers with instructions to select ASTM specifications.

The material requirements of the Code were discussed, and extended consideration was given to the matter of the quality of boiler steel specified for different parts of the boilers. This discussion was more thorough than any previous discussion and resulted in a complete modification of Pars. 113 to 120, inclusive.

The fourth session, on Thursday morning, was devoted to discussion of paragraphs beginning with 121 on stamping of boilers and continuing to the end of the Code. Questions of maximum allowable pressure, efficiency of ligaments, stamping of heads, dished heads, stay bolts, and other parts received detailed consideration and the differences of opinion which arose were argued to a satisfactory conclusion. It was also recommended that heating boilers and power boilers be placed in separate parts of the Code because of the adaptability of certain boiler constructions for each of these different services.

Requirements which tended to limit the size of boilers or enforce hardships on manufacturers were carefully considered. Rules relating to the length of plates on horizontal-return-tubular boilers and the lap joint on domes were modified. Certain ambiguities in statements were clarified.

The Thursday afternoon session at first considered Par. 1 of the "Recommendation of the Committee" to accommodate certain members who had to leave. The point was made that even the suggestions of a maximum diameter of 84 in. for a horizontal-return-tubular boiler would limit the size of this type of boiler below that which was considered to be good practice by some persons. A revision of the paragraph was

agreed upon to meet this criticism. Following this, advisability of the so-called Recommendation Section of the Code was discussed and it was noted that it had been discontinued in the Massachusetts Rules. The chairman of the Committee explained at great length the purposes and advantages of this section. The importance of Par. 12 of the Recommendations (on safety valves on hot-water boilers) was so great that after rewording it was transferred to the rules. There were no further suggestions as to the recommendations.

The session then returned to the Rules, starting with Par. 150 on flat surfaces and doubling plates and continuing to the end of the Code. Many paragraphs were extensively discussed; some changes were agreed upon for better application of the rules.

The sixth and final session was held on Friday morning, December 4, Vice-President I. E. Moultrop presiding. A few points which had not received proper consideration were taken up, such as feed piping, point of entrance of feedwater, the requirements of stopcock and check valve, blow-off piping, steam piping, water columns and their connections, and factors of safety for nonstandard and second-hand boilers. The matter of cock and check valve required a vote of the meeting to settle it, and the question of the factor of safety and age limit of boilers was referred to a committee consisting of A. M. Greene, Jr., F. Chamin, Wm. Kent, Frederick Sargent, F. H. Clark, Thomas E. Durban, and H. G. Stott.

A resolution was passed authorizing the transfer of the formulas for stays, cones, heads, tube sheets, furnaces and tubes to the body of the Code.

A motion for inclusion of the excluded efficiency tables after recomputation was carried, and a committee appointed to redraft the tables, although the Council had ordered their omission. The meeting finally discussed the policy of procedure for future revisions, the advisability of legislative requirements, and ended with another appeal for co-operative assistance.

ADVISORY COMMITTEE APPOINTED

After the Annual Meeting of the Society on Dec. 4, 1914, it was evident from the discussions at the six sessions on the Boiler Code Committee's Progress Report that the different groups could work harmoniously to formulate a Code which would be acceptable to users, the industries, and the States.

The remarks of Henry Hess on the necessity of co-operation had resulted in November in the appointment of an Advisory Committee of eighteen men representing different interests:

F. H. Clark, Railroad Subcommittee, ASME
F. W. Dean, consulting engineer
Thos. E. Durban, Boiler Manufacturers Association, Uniform Specifications Committee
Carl Ferrari, National Tubular Boiler Manufacturers Association
Elbert C. Fisher, Scotch marine and other types of boilers
Arthur M. Greene, Jr., engineering education
Charles E. Gorton, steel heating boilers
A. L. Humphrey, Railroad Subcommittee, ASME
D. S. Jacobus, water-tube boilers
S. F. Jeter, boiler insurance
Wm. F. Kiesel, Jr., Railroad Subcommittee, ASME
W. F. MacGregor, National Association of Thresher Manufacturers
M. F. Moore, steel heating boilers
I. E. Moultrop, boiler users
Richard D. Reed, National Boiler and Radiator Manufacturers Association
H. G. Stott, boiler users
H. H. Vaughan, Railroad Subcommittee, ASME
C. W. Obert, Secretary to the Committee

The Council was guided in these appointments by I. E. Moultrop, a vice-president of the Society who, as a Council member, was a most active supporter of the Committee.

FINAL DRAFT OF THE CODE OF 1914

The Committee and the Advisory Committee began the preparation of the Code (their final report) on Dec. 15, 1914, and nearly the entire membership of the two groups and the secretary, C. W. Obert, worked continuously, except on Sundays, from 10:00 a.m. until 11:00 p.m., for almost seven weeks, to produce the draft of the document. They considered the remarks and written communications presented at the six sessions and consulted committees and individuals for better understanding during this period. Evidently, the need of following the order of the Massachusetts Rules, as was done in the previous reports, had disappeared, and a more logical order for the application of the Code was followed.

It is to be noted that in basing the allowable working pressure on the ultimate strength and the factor of safety of 5 the Committee considered the matter of stress concentration at the ends of the diameter of open rivet holes perpendicular to the tension which had been shown by photoelastic tests reported in the literature of 1913 and also by such tests made for the Committee as well as by theoretical articles published before that date. The Committee also had before it the information sent by Dr. D. S. Jacobus to the Massachusetts Board of Boiler Rules on June 22, 1909, showing that although results of tests of the same steel in a number of independent laboratories showed a large variation in the reported stress at the elastic limit, the variations in ultimate strengths reported showed only such small variations as would be expected from pieces taken from different parts of the same sheet. It is well to remember that engineers of this period were using results of tests of full-size riveted joints from industrial and governmental laboratories in this country and abroad as a basis of design.

Printing followed preparation of copy. Not only the secretary to the Committee, C. W. Obert, but some members of the Advisory Committee went to the printing plant for proofreading and checking. The Committee had been instructed by the Executive Committee of the Council on Dec. 28, 1914, to present the Code in galley-proof form as soon as practicable, but pending consideration by the Council, no copies should be issued. This instruction was altered by the Council on Jan. 8, 1915, and the issuance of the galley proofs to members of the two committees was permitted. In this way the preliminary study of the galleys could be carried out for final presentation of the galley proof to the Council at its meeting on Feb. 15, 1915, with a short letter of transmittal from the two committees giving the object of the Code and its requirements and the recommendation for a permanent committee which would hold public hearings at least once in two years.

This first Code was now reduced to 114 pages with a complete index of 28 additional pages. It was made up of Part 1 (87 pages) for new installations and Part 2 (5 pages) for existing installations. An appendix of 20 pages contained methods of computing the efficiency of riveted joints, formulas for braced and stayed surfaces, safety-valve capacities, dimensions of standard flanged fittings, and fusible-plug requirements.

Part 1 was divided into Section 1 (80 pages) on power boilers and Section 2 (7 pages) on heating boilers. Subjects were treated under different paragraph titles in italics and main paragraphs were numbered consecutively throughout the Code from 1 to 430.

The first 13 paragraphs described the proper materials to be used for parts of power boilers and were followed by paragraphs on the ultimate strengths used in computing joints,

minimum thickness of plates, straps, tube sheets, and tubes. The ten specifications for boiler-plate steel, boiler-rivet steel, stay-bolt steel, steel bars, steel castings, gray-iron castings, malleable castings, boiler-rivet iron, stay-bolt iron, and refined wrought-iron bars covered 30 pages. They were identical or similar to those of the American Society for Testing Materials.

The three-page specification for lap-welded and seamless boiler tubes was prepared by the Boiler Tube Manufacturers of America.

The construction of power boilers and the maximum allowable working pressure were set forth in 36 pages. The allowable working pressure was based on a factor of safety of 5, the strength of the steel stamped on the plates, the inside diameter of the shell of the boiler or drum, and the efficiency of the longitudinal joints or the ligaments between tubes, whichever was the least. The allowable strength of joints welded by a forging process was also given as well as details of boiler joints, ligaments, domes, dished heads, braced and stayed surfaces, stays, tube sheets, furnace riveting, and calking. The requirements for manholes and handholes preceded the requirement for safety valves which had been rewritten as a result of the discussions at the sessions during the Annual Meetings to make them of greater use to inspectors and users. The subject of water and steam gages, fittings and appliances, settings, hydrostatic tests, and stamping completed Section 1.

Section 2 for boilers used exclusively for low-pressure steam and hot-water heating and hot-water supply referred in Par. 335 to the application of the Rules for Power Boilers (Section 1) to all steel-plate hot-water boilers (*a*) over 60 in. in diameter, and (*b*) where the grate area exceeded 10 sq ft and the maximum allowable working pressure exceeded 50 psi. Par. 336 called for the use of the specifications given in Pars. 23 to 178 (Section 1) in fixing the quality and properties of materials, and in 339 to the use of flange steel not less than $^1/_4$ in. thickness generally, and $^5/_{16}$ in. thickness for tube sheets and heads. The maximum allowable pressure was fixed at 15 psi for low-pressure steam heating and permitted cast iron to be used, while for steel plate in hot-water or steam heating, the factor of not less than 5 was required. The rules of this section then gave the requirements for boiler joints, washout holes, boiler openings, safety valves, steam and water gages, fittings and appliances, settings, hydrostatic tests, and stamping.

Part 2, of 5 pages, was formulated for existing installations and prescribed the maximum allowable working pressure with the least factor of safety to be used in different years after the approval of the Code. The age limit for continued use of certain types of boilers, factors of safety to be used with second-hand boilers, maximum allowable pressure on boilers with cast-iron or malleable headers or mud drums and on steam heating boilers, as well as discontinuance of boilers with cracks in a longitudinal riveted joint, were specified.

The unknown strength of steel was to be taken at 55,000 psi and the strength of riveted material was given. The capacities of safety valves and their determination were defined as well as details of installation, with provision for additional valves. The needed steam and water gages, valves, pipes and fronts, as well as hydrostatic pressure tests, were specified.

The twenty-page Appendix gave the methods of computing the efficiency of seven different forms of riveted joints and illustrated two forms of double-butt-strap joints of high efficiency, as well as data on braced and stayed surfaces. Methods used in determining the capacity of safety valves and in checking the capacity from the amount of fuel burned, dimensions of standard pipe fittings, and requirements for fusible plugs for different types of boilers concluded this addition to the Code.

ACTION OF ASME COUNCIL ON THE REPORT

The minutes of the Council meeting on Feb. 13, 1915, note (item 685) that the Committee and Advisory Committee were received and the complete report was presented; and it was voted that (*a*) no copyright be obtained for the report; (*b*) that the report be received as presented in galley proof and that it be printed in *The Journal* and in the Transactions;[1] (*c*) that the Boiler Code Committee and the Advisory Committee be continued for one year as one committee instead of separate committees as formerly and that it be known as the Boiler Code Committee; and (*d*) that the Council expressed its appreciation of the unprecedented amount of time and work that the various members had given to the preparation of the report and of the splendid results.

Because the rules of the Society prescribed that members of a standing committee of the Society be limited to five, with the members of longest service retiring each year, it was recommended and agreed that because of the continuing nature of its work, the Boiler Code Committee should be a special committee to be appointed each year and that in general, the Committee would recommend to the Council its personnel.

THE PARKER PROTEST

The earlier item 684 of the minutes of the Council meeting of Feb. 13, 1915, records the fact that John C. Parker, who had presented a written protest to the Council meeting of Jan. 8, 1915, reported his protests personally in connection with the issuance of the Code. It was voted that Mr. Parker be invited to formulate his objections to such parts as he thought important and improper and submit these to Professor Greene, member of the Council, who would in turn report to the Council and see what adjustment could be made. Professor Greene later reported that Mr. Parker had met with the Boiler Code Committee and Advisory Committee and was unable to come to any agreement.

CODE BECOMES AN OFFICIAL DOCUMENT

At the Council meeting of Mar. 12, 1915, it was voted to reconsider the matter of copyright (item 710), and after that date the copyright for the Code was approved, as was also the title, Rules for the Construction of Stationary Boilers and for Allowable Working Pressures.

The ASME Boiler Code was now an official Society document with the approval of its governing body, the Council. The details of its production and the Council actions given here have been included to indicate how closely the Council has acted at all times, so that any actions taken were those of The American Society of Mechanical Engineers, with all of the prestige which comes from its history, membership, and reputation. From the very inception of the plan for a boiler code, the Committee has always been answerable to the Council.

Five years after Col. E. D. Meier asked the Council of The American Society of Mechanical Engineers to approve appointment of a committee to formulate standard specifications for the construction of steam boilers and other pressure vessels, the first ASME Boiler Code had come into existence and the ASME Boiler Code Committee was established. Patience, diplomacy, persuasiveness, and co-operation of many persons and groups carried the project through to completion. But with an approved Code, the work of the Boiler Code Committee had only just begun. Almost immediately the Committee found itself pitchforked into a situation demanding the administration of the Code, the establishment of methods of procedure, and the interpretation of its provisions. How the Committee met this situation is told in the next chapter of this history.

[1] Transactions ASME, vol. 36, 1914, pp. 977–1086.

A Suggested FILING SYSTEM

For Keeping Abreast of Technical Literature and General Information of Interest to the Engineer

By G. A. HAWKINS[1] and L. M. K. BOELTER[2]

INTRODUCTION

KNOWLEDGE is power. Thus the energetic farsighted engineer is ever thirsty for knowledge, but facts and experiences when stored in the mind, each as a separate entity, lead to confusion and weakness. Hence there exist two reasons for continuing the study of the literature. The first is to add vicarious experiences to those encountered on the job. The second is to aid in the process of formulating (and integrating) the several experiences, or the recognition of the single experience, as one of a class already established. The generalization of one's experiences is at once a timesaver, and an energy conservator. The extent to which the professional engineer generalizes and formulates his experiences into general frames is a measure of his stature.

Indeed the professional engineer, in preparing his daily engagements or assignments, essentially extrapolates his experiences (his knowledge). He seldom is called upon to repeat a solution previously accomplished. The process of extrapolation is rendered less hazardous if based upon formulated knowledge rather than upon the isolated experiences of the engineer.

Again, the engineer must keep the time gap between the productive output of the physical scientist and its application at a minimum. Thus a systematic study of the scientific and engineering literature is indicated. One or more reference files then become imperative.

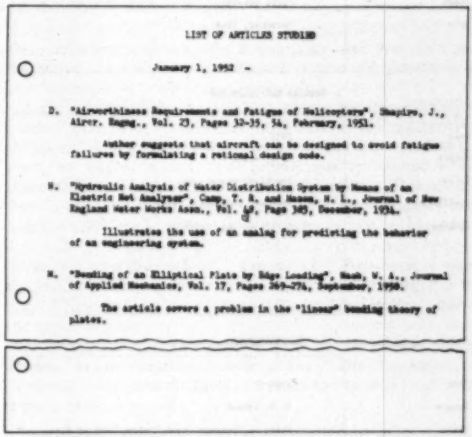
INITIAL TECHNICAL REFERENCE FILE

To begin, the several fields of interest may be designated by letters, say, M for mechanics, D for design, H for hydraulics, and so on, and a running list of the articles studied, perused, or briefly noted, kept on 8½ × 11-in. paper, each entry being designated briefly by the letter corresponding to the general field of interest. Comments bearing on the extent of the engineer's knowledge of the content of the article also may be included. The entry can be of most value if the standard forms utilized in reference listing in the publications appearing most often in the list are adopted. A sample list is shown in Fig. 1. As this scheme develops it may be transformed readily into the procedure which follows.

A PERMANENT REFERENCE FILE

Numerous requests are received from engineering graduates as to methods for establishing a permanent personal file of technical reference material. Often these engineers are in doubt as to how to organize their documents effectively, so that they may be able to locate a particular article quickly. After employing various filing systems, a satisfactory procedure was found and will be discussed. This particular filing technique has proved successful in connection with a file covering over three thousand items.

The method is based on the principle that all items are filed



LIST OF ARTICLES STUDIED

January 1, 1952 -

D. "Airworthiness Requirements and Fatigue of Helicopters", Shapiro, J., Aircr. Engng., Vol. 23, Pages 32-35, 36, February, 1951.

Author suggests that aircraft can be designed to avoid fatigue failures by formulating a rational design code.

H. "Hydraulic Analysis of Water Distribution System by Means of an Electric Net Analyzer", Camp, T. R. and Hazen, H. L., Journal of New England Water Works Assn., Vol. 48, Page 385, December, 1934.

Illustrates the use of an analog for predicting the behavior of an engineering system.

M. "Bending of an Elliptical Plate by Edge Loading", Nash, W. A., Journal of Applied Mechanics, Vol. 17, Pages 369-374, September, 1950.

The article covers a problem in the "linear" bending theory of plates.

FIG. 1 TYPICAL REFERENCE LISTING

according to the year of publication. In this way the material may be placed in filing cabinets, boxes, or other suitable containers, which may be stored in the basement, attic, or closet. For discussion purposes this file will be called the "base" file. In order to reduce the bulk of the base file, important articles may be cut out of the magazines, and the remainder discarded. A small 3 × 5-in. card file is prepared and used to locate the specific items in the base file. The small card file may be placed in a desk drawer or in a cabinet.

The reason for arranging the base file according to date is that in the majority of instances technical information is cumulative, and usually the latest information recapitulates or supersedes the earlier data. Storage of the material in out-of-the-way places according to date is feasible because of lessened use owing to the gradual obsolescence of the material.

For each item in the base file, three identical cards are prepared, and located under three divisions, namely, year, author, and subject. There is a distinct advantage in using three different colors for the cards, which may be procured from supply houses. The one set of cards filed according to date constitutes a model of the base file. The author and subject divisions are supplementary, but are very useful.

If it is desired to locate an article which the engineer believes to have been published between 1930 and 1934, he need only look through the year card file. In the event it is necessary to survey the available material according to subject, then the subject card file is used. If the date of publication is unknown, but the name of the author is known, then the desired article may be found by referring to the author card file.

In order effectively to maintain a general filing system of this type, it is necessary to keep it up to date. It has been found

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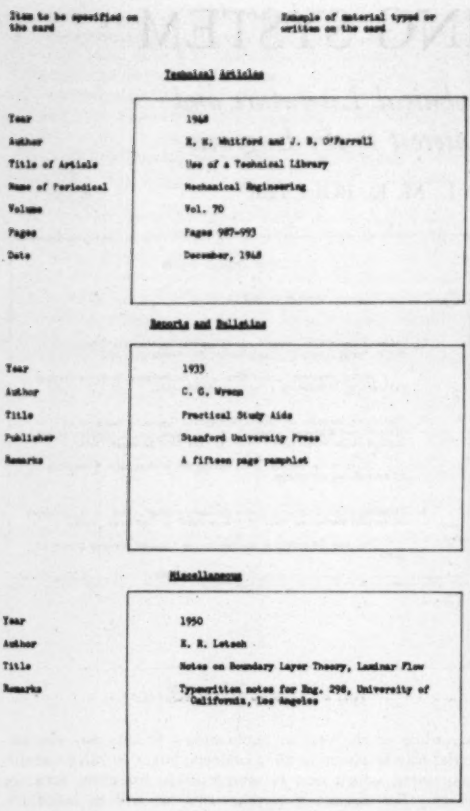

FIG. 2 SUGGESTED FORMATS FOR DIFFERENT CLASSES OF INDEX CARDS

that one evening per month devoted to the task is usually sufficient, unless a very large number of periodicals or other material are to be filed.

The material may be classified according to the following groups: Published technical articles, reports and bulletins, and miscellaneous items. Suggested formats for the three index cards for each class are shown in Fig. 2.

Notebooks are often needed only on special occasions; hence these items may also be catalogued and placed in the base file. The year-file card would indicate the name of the author of the notebook and a statement such as, "Notes on the Design of Transformers."

It is often necessary to prepare two or more sets of subject index cards for a single technical article. For example, an article covering the factors affecting boiling of a liquid might contain an interesting part on the use of high-speed motion pictures for the study of bubble formation. Two subject index cards might be prepared for this article: one for the subject heading "Heat Transfer, Boiling," and the other for the heading "Photographic Techniques."

In the preparation of the subject division card file, the tendency is usually to use too many subdivisions. For sake of simplicity the number of subject headings should be limited as much as possible. The engineer must be on guard constantly not to file articles now under one classification and then under another, thus dividing his reference. At a later date when consulting the subject card file he may easily overlook pertinent material. For example, an engineer interested in ultra-high-frequency work should choose either the words "Klystron" or "Velocity-Modulatron Tubes" as a subject heading, and not file material under each heading. Under any condition indexing material according to subject matter is tricky; however, an occasional check of a file such as "Engineering Index" will aid an engineer to keep fairly consistent classifications.

Interesting articles or texts read by the engineer, for which copies are not available for the base file, may be recorded in the usual manner and placed in the subject card file. A note on the card would indicate that the articles are not in the base file, but are available in a particular library, in a friend's collection of reference material, or in some other location. The use of a different-color card for this material is very helpful.

In addition to serving the purpose of locating material, the year card file also may be used to record loans. Whenever an article is loaned, a note may be written on the year card for later reference indicating the name of the borrower and the loan date.

It should be pointed out that no fellow engineer, librarian, or literature searcher can organize an engineer's material for his own use as well as he can himself. Therefore changes from this suggested procedure may easily be made to suit the needs of an individual. Additional information and suggestions may be found in the several references cited.

CONCLUSION

In presenting this procedure for technical reference filing, the authors are mindful of the fact that in a large measure the energy of the professional engineer must be expended in continuing his education after graduation. Primarily his post-graduate professional training and education in industry deserve a special place in his on-the-job planning and activity. Then too, his general education in the humanities, arts, and sciences also must progress.

The measure of an educated man is whether he can discuss the problems of his neighbors (for example, lawyers, shopkeepers, gardeners, ministers, and the like) in their language, while the measure of an ignorant man is taken by observing that his discussion with his friends and neighbors consists of his own problems stated in his own language (technical).

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ADEQUATE and accurate filing requires a system or a procedure just as surely as a system or a procedure is required for shipping, purchasing, or other routines, it is reported in an article in *Systems Magazine*, July, 1952. It should be as simple as adequate filing will permit, yet thorough enough to answer every need. It must be broad enough to meet the requirements of the smallest and most remote office to the largest of district offices. It must be tailored to fit the business.

An analysis of filing will usually lead to changes that save space, reduce labor, cut costs of equipment, and increase efficiency generally. Such an analysis, made by the Westinghouse Electric Supply Company, resulted in several important money-and-timesaving changes in over-all filing operations.

The analysis sets up indexing rules, sorting procedures, the method of establishing cross references, follow-up technique, and transfer schedules for removing material to inactive files.

Let's Take the Strait Jacket Off TECHNICAL STYLE

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ANYONE closely associated with members of the engineering profession soon develops a healthy respect for their practical, down-to-earth approach to most of their problems. Their interest in efficiency, in cutting through irrelevant material to arrive at a workable solution—in short, their common-sense analysis leading to a constructive result—these qualities have impressed me deeply over many years of close contact.

Why, then, in one aspect of their work, do engineers paradoxically cling to tradition, persisting in doing things the way they have always done them and remaining highly uncritical of the results? The aspect of their work to which I refer is their method of writing reports. This style is not only completely inconsistent with the objectives of their profession; it is, I believe, generally inefficient, outmoded, and wasteful chiefly because the engineer has permitted the "strait jacket" of custom to hamper his style of writing.

HOW THE ENGINEER GOT THAT WAY

Let's take a look at this strait jacket which shackles most technical writing. The conventional injunction taught to generations of engineers is "Write reports in a formal, impersonal style," or "Use the third person passive voice in your reports." One typical book on engineering reports says:

> Good technical style is slightly formal; impersonality is the rule. Instead of "We completed the experiment," the preferable form is "The experiment was completed." All pronouns of the first and second person, colloquialisms such as "a lot of," and contractions such as "don't" are to be avoided. Yet despite the professional tone, a successful report reflects its writer's personality.

These instructions should puzzle a thoughtful reader—and if he applies the methods he's learned as a good engineer or scientist, he might well ask why reports clothed in such style are effective and how "a successful report reflects its writer's personality" when the instructions quoted can only mean formal, impersonal—and deadly dull—writing.

In all fairness, we should admit that these "rules" governing report style have developed from the engineer's laudable desire for modesty and his desire to avoid injecting himself into the reports of his activities. Uniformity in report writing undoubtedly has some advantages, but when the uniformity results in dull and difficult reading, I seriously question its value. It is certainly curious that engineers and scientists, who of all people in modern society are most concerned with developing efficient methods, have condemned themselves to a form of writing which is inevitably awkward, wordy, and inefficient.

Engineers can begin to break this strait jacket by doing two simple things:

1. Start using personal pronouns.
2. Write in the active voice instead of the passive.

Actually, these instructions are identical, because you can't personalize without using the active voice, and you can't use the active voice without getting a few personal pronouns in your reports.

Let's take a simple example. A sports writer reporting a baseball game says, "Feller threw three strikes to Mantle, ending the game." If we follow the rules which shackle technical reports, we ought to say, "The contest was terminated when three strikes were thrown by Feller to Mantle." This second version not only requires more words; it is also awkward and indirect. For the basic fact in all communication is that when somebody does something, the obvious way to report it is in terms of "who does what." Instead of "Three strikes were thrown by Feller" (passive voice), the logical technique is to say, "Feller (who) threw (does) three strikes (what)," using the active voice.

In commenting on this awkward use of the passive voice, *Fortune*, in an excellent article called "The Language of Business," examined the flaws of written and spoken English in today's business world:

> First, the written variety—and that infamous jargon, which for want of a better term, we'll call *businessese*. Almost invariably, *businessese* is marked by the heavy use of the passive construction. Nobody ever *does* anything. Things *happen*—and the author of the action is only barely implied. Thus, one does not refer to something, reference is made to; similarly, while prices may rise, nobody *raises* them.

For a brilliant and amusing example of what "report style" will do to good English, you might take a look at Philip Swain's excellent article called "Shakespeare Rewrit." *Chemical Engineering* reprinted it in June, 1950, following its original appearance in *The American Journal of Physics* in October, 1945. Engineers who want to write concisely and directly can take heart from the fact that two such highly respected technical journals struck an effective blow at awkward and formalized style by printing Mr. Swain's words.

This conflict between an established tradition and an efficient style puts the engineering student—and his English instructor—between the devil and the deep blue sea. In fact, your own reactions right now may be summed up with plenty of passive, "the point of view which is being advocated by the writer of this article is putting its reader in the position of being between his satanic majesty and the deep azure body of water which covers almost three quarters of the earth's surface!"

HOW THE ENGINEERING JOURNALS DO IT

For if you read very much in your professional journals, you can hardly forget that this formal tradition has the highest authority behind it. Let's look at a few examples from engineering journals. Here is the vice-president of a national engineering society writing his farewell:

> Your Vice-President cannot conclude his two-year term of office without expressing his deep gratitude for the wholehearted co-operation he has received from the other national officers with whom he has served, from the officers of Sections and Branches, and from the members of the Committee on Sections and Branches. Whatever degree of

[1] Director, Division of Humanities and Social Studies.

success has attended his efforts to serve our Society has been in large measure due to the inspiration, guidance and co-operation of these gentlemen. He can wish his successor no better fortune than that he be favored with a continuation of the same co-operation.

What this eminent gentleman really means if we get him out of the strait jacket is:

As I conclude my two-year term as your Vice-President, I want to express my thanks for the co-operation of the other national officers and committee members. Any success I have had in serving the Society comes from their guidance and inspiration, and I hope my successor will receive the same co-operation I have had.

This "sounds" as if a human being had written it—and that is important for the engineer and the engineering student. In a considerable amount of consulting in industry, I have learned that business executives, generally, do not want any "special style" for report writing and that engineers write, not only for engineers, but for readers who are salesmen, lawyers, accountants, personnel men, and for members of the advertising, operating, and purchasing departments. The one quality all these people have in common—other than the fact that they all work for the same company—is that they are all human beings. And as one top flight executive remarked, "I don't care about anything else in a report as long as it is accurate, concise, and sounds as if it had been written by one human being for another—which most of our reports don't." Nor will you, as so many engineers think, have to sacrifice accuracy if you personalize and write the way you would talk. In fact, you'll probably be more accurate and certainly more concise because you will be using a style you would naturally use instead of one you think you ought to use.

CULTIVATE A PERSONALIZED DIRECT STYLE

More important, a personalized, direct style is economical and appropriate to the functional purpose of conveying information, which is the primary objective of all the engineer's writing. Wasted words mean wasted money, in reading time, in writing, and in publication. In the last classification, I find it inconsistent for a newly elected president of a great national engineering society to announce his plans for the coming year in the traditional indirect pattern:

Some of the organization changes made may not be satisfactory or desirable. In such instances, adjustment should be made, not hastily, but as experience indicates the way. Further reorganization may be necessary to relieve the burden on some committees, committee chairmen, and officers. The organization required to meet the needs of the Institute should be a subject of constant study and investigation in order that growth and development may not be impaired by an inadequate or unwieldy administrative structure.

If we translate this into terms of "who does what," we can say this in about half the words:

During the coming year, we ought to review some of our organizational changes on the basis of our past experience. Specifically, we should decrease the amount of work required for certain committees and officers and constantly study our organizational structure to make it adequate and effective.

This waste of words should interest all members of technical and scientific societies in a period of rising costs. In fact, the same issue of the magazine from which I have quoted the new president's message contains a committee report on the society's publication. By reducing the magazine's size from $8^3/_4 \times 11^3/_8$ in. to $8^1/_4 \times 11^1/_4$ in., the organization "will effect a saving of $10,000 annually in the cost of paper and reduced postage." Might the principles of engineering economy suggest that they could effect savings several times that amount by insisting on a straightforward style? Unfortunately, this same economy-minded committee's summary contains the same old strait jacket on style:

One of the ways in which a high standard of publication has been maintained is by continuing the policy of not republishing material which has been published previously.

Translation:

Our policy of not republishing materials from other journals helps greatly in keeping our standards high.

Another national publication contains page after page of research reports with the same dreary evidence of the strait jacket on style:

"It has been reported by Smith and Jones," instead of "Smith and Jones reported."

"In a previous communication, it was shown that" instead of "A previous communication showed."

"In connection with some of the oxidation studies underway in this Laboratory, it became of interest to investigate, etc.," instead of "Our studies of oxidation interested us in investigating, etc."

"The preparation of this paper has been greatly facilitated by helpful discussions with Professors Black and White," instead of "Professors Black and White have helped us greatly in preparing this paper."

"In Table 1 are summarized the effects of several catalysts, etc." instead of "Table 1 shows the effects of several catalysts."

"The author is appreciative of the invaluable comments of Professor Doakes which have been of great assistance to him" instead of "Professor Doakes has helped me greatly by his comments."

The editors of this journal apparently print these reports without change; at least, we may assume that they approve this kind of style, particularly when we look at their instructions on how to make claims for missing numbers of the journal. Here they succeed in carrying the passive to its logical—and wordiest—conclusion:

Claims for missing numbers will not be allowed . . . if loss was due to failure of notice of change of address to be received before the date specified in the preceding paragraph. . . .

In other words:

We cannot grant claims for missing numbers unless we receive notice of change of address by (date).

DISASTROUS EFFECT ON ENGINEERING STUDENTS

This kind of writing affects engineering students disastrously, the more so since the national societies have done a magnificent job of working with their student branches. These are the publications the students see, these are the men who carry authority and prestige in their profession. Who can wonder, then, when the freshman engineer writes his lab reports, beginning thus:

The purpose of this experiment is to study the motion of a falling tuning fork and to determine the acceleration.

The tuning fork is mounted on a carriage which has been supported on vertical rods and is made to vibrate in a uniform way.

And going on inevitably to the conclusion:

A graph is then made with velocity vs. time being shown. A straight line is formed showing the increasing velocity and the acceleration is found to be 263 feet per second squared.

After four years of writing and reading this style, the senior naturally begins his application letter in this fashion:

The writer (sometimes "the undersigned") would like to be considered for a position which may be available in the Blank Company.

Let no English instructor try to tell him this is awkward

(*Continued on page 664*)

PRICE CONTROLS IN MOBILIZATION[1]

By E. CARY BROWN

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

ARMING for defense imposes heavy drafts on output—drafts that can be met in our economy only by rearrangement of peacetime patterns of output. The rearrangement procedure is by no means simple to work out. The problems it gives rise to create controversy, none of which is more intense than that regarding the role of price-wage controls in the emergency.

Burgeoning demands for military equipment and personnel, when added to demands for consumer goods and for peacetime plant, equipment, and inventories, place heavy pressure on markets. Unless supplies of goods can be increased to meet this added demand or private demands can be reduced, this pressure will force up prices. Price changes can feed back to higher wages, which in turn, by pushing up business costs and incomes, can raise prices again. A gap once opened up between demand and supply can initiate the familiar spiral of inflation in this way.

An inflationary spiral is a major tragedy of defense or war mobilization. Not only does it permit a capricious and unfair distribution of income; it also impedes the mobilization effort. Price rises in civilian industries create the basis for higher wages and profits. Higher wages and profits in turn induce capital and labor to remain in the field they are in rather than to switch to defense production.

One way of avoiding inflation is to bring total supply and demand into balance, either by reducing demand or increasing supply, or both. But neither of these methods is an unmixed blessing. Expansions in output increase incomes by an equal amount. While not all of this added income represents added demand for output, some, and probably a substantial fraction, does. The necessary expansion in supply to an equilibrium level must, thereby, be much larger.

Reductions in demand through the traditional methods of taxation and monetary-credit restraints also have their problems, quite aside from the political problems involved. Use of taxation on the massive scale necessary for all-out mobilization could have disastrous effects on incentives to additional personal effort and output. Similarly, sharp rises in interest rates, the technique for reducing demand, could create a distribution of income that would be anathema to important groups and could inhibit their output. Thus reductions in demand could also reduce supply, necessitating still heavier demand cutbacks.

Suppose that instead of trying to bring supply and demand into equilibrium, prices and wages were frozen. Would these problems then be avoided? True enough, disincentive effects would be reduced; and, provided the controls held, there would be no inflation. Unfortunately, the controls might crumble away. When prices are held below the equilibrium level, demand exceeds the amount of available output. Black markets arise and price ceilings can become meaningless. There is pressure for resources to flow toward civilian industry and away from defense output. Rationing and additional direct controls might help for a time, but they, too, would break down if the excess demand were too large.

In the face of this dilemma, how did we mobilize for the last war? How can we for the present one? "A Theory of Price Control"[2] is concerned precisely with these problems. It contains the reflections of Prof. J. K. Galbraith of Harvard University on the lessons to be learned from the economic mobilization of the last war and their applications to the Korean War. Professor Galbraith was strategically placed to view the formulation and operation of price controls as an OPA administrator; his academic background has led him to examine his experience analytically; as a former editor of *Fortune Magazine* he is singularly well-equipped to write of it. The result is an entertaining and stimulating discussion of the functions of price controls. In the process of elaborating their functions, he provides us with important insights into the economic problems of mobilizing. Professor Galbraith was the first to see in the improvised economic structure of World War II a rational pattern for mobilization—a pattern which he termed the "disequilibrium system." This position was first set forth in a series of essays in the professional journals. Fortunately, it is now made available to a wider audience.

In World War II a combination of economic policies was adopted. Output was expanded enormously, both through an increase in the labor force and through its more intensive utilization. Heavy taxes and credit restrictions were imposed to cut back the demand generated by rising incomes. But none of these steps was adequate to bring demand and supply into equilibrium. The remaining large excess demand was repressed by imposition of price and wage controls.

While taxes large enough to tailor demand to supply turned out to be politically infeasible, Professor Galbraith's position is that, even had such an expedient been feasible, World War II mobilization would have been less effective thereby. In the first place, the disequilibrium system called forth more output than would have resulted had demand been reduced adequately to prevent prices from rising. He believes, and there is much evidence to support his position, that equilibrium between demand and supply would not have held prices in line. Industries in which there are relatively few firms would not be exploiting fully the demand situation. Higher prices could be charged with little or no loss in the quantity sold. Strong unions, and they are usually strong in such industries, could then demand higher wages with little resistance from firms in the industry. The latter could pass such wage increases on in higher prices. These higher prices would spread to other parts of the economy, and a spiral could be initiated. Professor Galbraith believes that demand must be cut back to such an extent as to create unemployment, if this type of inflation is to be avoided. Unions then have little or no inducement to ask for wage increases and a stable price level may be maintained. But this is a high price to pay for economic stability. It means unemployment and the loss of sorely needed output.

A second virtue of the disequilibrium system was that excess demand is used as a powerful magnet to attract additional workers into the labor force. By having an excess demand on all sides, potential additions to the labor force—wives of servicemen, housewives, retired personnel, etc.—easily found places in which to work. Had demand been reduced sufficiently, unemployment in some areas would have deterred people from joining the labor force.

Another way in which the labor force was expanded was

[1] One of a series of reviews of current economic literature affecting engineering, prepared by members of the Department of Economics and Social Science, Massachusetts Institute of Technology, at the request of the Management Division of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Opinions expressed are those of the reviewer.

[2] "A Theory of Price Control," by J. K. Galbraith, Harvard University Press, Cambridge, Mass., 1952. $2.

through the promise held out by price controls that in the future dream houses, cars, durables of all sorts could be purchased at existing prices. Had people had to rely on current output as the full reward for effort, its scarcity for civilian use might have reduced the output of those who found these rewards inadequate.

In the third place, increased voluntary savings, both of business and consumers, played an important role in holding back demand. To some degree, they too depended on price controls. As Professor Galbraith emphasizes, price stability during the war period assured consumers and business firms that postwar prices would be at least as low as the wartime ones, and possibly lower. Consumers had no incentive then to dash out and purchase goods to hoard against future price rises. Had price speculation been more evident, demand for output would have swelled noticeably and direct controls would have been under heavy pressure.

These are the important virtues of the disequilibrium method of mobilizing. It also has dangers, however, the major one of which is that direct controls may break down. If they do, resources will not find their way into the channels that aid the mobilization process. They may be drawn away from the military to the civilian market; away from necessities toward luxuries. Professor Galbraith believes that direct controls were sufficiently effective in World War II in the face of excess demand. Let us see how a poor allocation of resources was minimized.

When prices are set too low, then their function of rationing demand has been impaired. Some other method must be used. As we can well remember, formal rationing was used in some markets, such as meat, sugar, gasoline, etc. Professor Galbraith points out that it was not necessary in every market—that in markets containing a relatively few sellers, informal rationing could be initiated. These markets were not the impersonal auction-type markets found in agriculture and other commodities of this type where firms do not identify their products. Instead, there was a seller-buyer relationship that made it possible for the seller to ration buyers in a fairly satisfactory manner on the basis of their needs. Price controls worked in these industries without the added awkwardness of formal rationing. And it was precisely these industries where the wage push could be the most serious and where price controls could be needed the most. Thus it would appear that price controls were much more effective than many economists imagined prior to World War II.

But even if price controls hold and the allocation of resources reasonably conforms to the proper pattern for mobilization, there are still difficulties with the disequilibrium method. The piling up of business and consumer savings can be carried too far. These added savings would be kept in highly liquid form—Series E and other government bonds, time deposits, demand deposits, etc. As the more urgent postwar needs of consumers and business firms are "satisfied" by these liquid assets, the pressure for them to save for the future and to make extra effort to earn extra income is reduced. Rates of saving and output then tend to fall and inflationary pressures increase. Continued movements in this direction can overstress controls. The whole economic mechanism could then break down in a surge of inflation and black markets.

This critical amount of savings Professor Galbraith has termed the "margin of tolerance," varying from country to country and from time to time in the same country. He interprets the situation in this country in World War II as well within this margin, and, more controversially, that the sharp postwar inflation could have been avoided had wartime controls received a more orderly liquidation. Germany, in contrast, exceeded its margin of tolerance even without a breakdown of all controls. Output dropped sharply as the accumulation of liquid assets came to have less and less significance to consumers.

The job for fiscal-monetary policy in the disequilibrium system is to keep accumulated liquid assets within this margin of tolerance. It has a secondary role to play in contrast with the primary role assigned to it when total supply and demand are equated. Nevertheless, this is an important function. For, once the margin of tolerance is exceeded, the resulting inflation would be drastic. Consumers and business firms would step up their spending; the large accumulation of liquid assets would then be available for spending. Fiscal-monetary policy becomes virtually helpless to cope with the situation. Only extreme measures, such as the postwar monetary reforms of some European countries, can then set the economy back on its feet.

Despite his favorable attitude toward the disequilibrium system in World War II, Professor Galbraith does not recommend it for the Korean War, primarily because the margin of tolerance of our economy is so much lower than it was in World War II. Then we had just recovered from a deep depression to which most thought we would return; saving for a rainy day was almost an instinctive reaction. Then we had a complete mobilization; this time it is only partial. When relatively few goods are available, it is easier to hold consumption expenditures down; now, when quantities of consumer goods are available, it is much harder. Then peace lay ahead a few short years; this time we can only hope that the present situation will not worsen. Then we expected prices to fall in the postwar period; now we have recently been through a sharp inflation during which liquid assets were reduced substantially in value.

Given this reduction in the margin of tolerance, Professor Galbraith places primary reliance on fiscal-monetary controls in the present partial mobilization. But he inveighs against regarding this as an alternative to price controls. They still have a secondary role to play: to backstop fiscal-monetary controls by preventing price changes from cumulating into large swings that would establish a basis for higher wages and initiate an inflationary spiral. If the percentage of resources needed by the government rises, there may then be no alternative but to proceed by a disequilibrium system and hope for the best.

"A Theory of Price Control" is a lucid presentation of a compelling point of view. For one who wishes to sit down to a stimulating evening of reading in the field of political economy, this book can be highly recommended. Professor Galbraith's position is deserving of a wide hearing in the current debate over economic techniques of arming for defense.

NEW STEEL plant construction today is costing several times as much per ton of ingot capacity as it did prior to World War II, according to statements made by several executives of the industry at hearings before the Wage Stabilization Board, it is reported in *Steel Facts*, June, 1952.

The original cost of one large company's plant and equipment, going back over a long period, averages $77 a ton of ingot capacity, compared with an estimated cost now of similar erection in excess of $200 an ingot ton, or nearly three times as much.

This company at one of its plants has an open-hearth department containing nine furnaces with total annual capacity of 1.2 million tons of ingots. The units of this plant were built at various times from 1918 to 1943, at an aggregate cost of slightly over $9 million, complete with related facilities. Now this company is building a plant of eight furnaces, also with a total annual capacity of 1.2 million tons of ingots a year, at a cost of $38 million—more than four times as much.

BRIEFING THE RECORD

Abstracts and Comments Based on Current Periodicals and Events

J. J. Jaklitsch, Jr., *Technical Editor*

MATERIAL for these pages is assembled from numerous sources and aims to cover a broad range of subject matter. While few quotation marks are used, passages that are directly quoted are obvious from the context, and credit to original sources is given.

Canadian Hydro Development

THE huge Nechako-Kemano-Kitimat Hydroelectric Power Development and the adjoining aluminum reduction plant at Kitimat, B. C., Can., was described by F. L. Lawton, chief engineer, power department, Aluminum Laboratories, Ltd., during the annual meeting of The Engineering Institute of Canada held recently in Vancouver, B. C.

Mr. Lawton said that to produce one pound of metal approximately 10 kwhr of electricity is required. Therefore large blocks of cheap hydroelectric power are the basis on which the aluminum industry has been built. Cheap transportation also is required because bauxite, the basic ore of aluminum of commercial grades, is found only in tropical and subtropical zones of the earth. About five pounds of bauxite is required per pound of aluminum.

The new development in British Columbia is being located at Kitimat because cheap water power and cheap transportation are available. There are also excellent harborage facilities and good ground for a townsite. Mr. Lawton said that with an ultimate firm delivery of Kitimat of 1,670,000 hp and installed capacity of 2,240,000 hp, the decision of the Aluminum Ltd., early in 1951, to proceed with the first stage of the over-all project constitutes a notable milestone in the growth of the aluminum industry. This decision marked the start of construction on the greatest hydroelectric power development ever financed by private capital, he said.

According to Mr. Lawton, with 10 kwhr of electric energy from water-power resources going into each pound of aluminum ingot from Kitimat, along with the necessary ingredients of cheap transportation, skilled labor, engineering knowledge, industry know-how, and financial courage, Nechako-Kemano-Kitimat truly can be termed a producer of packaged hydro power, for distribution to the free world.

On April 21, 1951, the decision was reached to proceed, on the basis of a power development involving equipment of 450,000 hp of the initial stage of the ultimate 1,670,000 hp firm capacity transmission facilities, aluminum-reduction plant, townsite, and port.

The powerhouse site is 10 miles from Kemano Bay, and the plant and townsite can be readily reached by sheltered ship channels from either Vancouver or Prince Rupert. An interesting feature is the fact that the power plant will be constructed underground. More than 75 such plants have been built or are being built in various parts of the world.

The Kemano power plant, when completed, will have installed 16 vertical, single-runner, four-nozzle impulse turbines, each rated at 140,000 to 150,000 hp at 327 rpm. Space requirements, for the complete development, necessitate a chamber over 1000 ft long, 80 ft wide, and 135 ft high. A small village will be necessary at the power plant to accommodate operating and maintenance personnel.

The reduction plant is being built partly on the delta of the Kitimat River, and partly on alluvial fans that have been deposited on the edge of the delta by two creeks. The townsite is intended ultimately to house 50,000 people. Planning and engineering, Mr. Lawton said, for the townsite in such a remote area, with no initial facilities, has required the services of a number of specialists, all of whom feel that, in spite of difficulties due to climate, sloping ground, gullies, and heavy timber cover, there is a unique opportunity at Kitimat to produce a community free from the inherited mistakes and congestion that cause so much expense in other places.

Other facts also given by the speaker about the project included the following:

1 When completed, it will be the largest underground power development in the world, having a firm capacity more than three times the ultimate installed capacity for Sweden's Harspranget development and about 1.7 times that for Brazil's combined Forc a cava No. 1 and No. 2 plants.

2 It will have an installed capacity substantially in excess of Boulder (Hoover) Dam and be exceeded only by the now-completed Grand Coulee development of 2,250,000 kw.

3 It will have an annual firm energy generation well in excess of the estimated 8,100,000,000 kwhr firm from Grand Coulee.

4 The Kenney Dam across the Nechako Canyon will be the third highest rockfill dam in the world.

5 The Nechako storage reservoir will have a capacity only

How to Obtain Further Information on "Briefing the Record" Items

MATERIAL for this section is abstracted from: (1) technical magazines; (2) news stories and releases of manufacturers, Government agencies, and other institutions; and (3) ASME technical papers not preprinted for meetings. Abstracts of ASME preprints will be found in the "ASME Technical Digest" section.

For the texts from which the abstracts of the "Briefing the Record" section are prepared, the reader is referred to the original sources: i.e. (1) The technical magazine mentioned in the abstract, which is on file in the Engineering Societies Library, 29 West 39th St., New York 18, N. Y., and other libraries. (2) The manufacturer, Government agency, or other institution referred to in the abstract. (3) The Engineering Societies Library for ASME papers not preprinted for meetings. Only the original manuscripts of these papers are available. Photostat copies may be purchased from the Library at usual rates, 40 cents per page.

exceeded by Boulder Dam's Lake Mead and by Fort Peck Dam. It will be twice that of Grand Coulee.

6 The vertical turbines will be the world's greatest-capacity impulse-type units.

7 The 2600-ft-head 11-ft-diam pressure conduit is in so far as known not exceeded by any other built or under construction today.

8 The 300-kv oil-filled power cables will constitute the highest-voltage power cables in service in North America and the second highest in the world, only exceeded by the 380-kv cables at Harspranget in Sweden, which are presently operated at 230 kv.

9 The transmission-system loading will be the world's highest, by a substantial margin.

10 The transmission-line conductors will be the largest ever fabricated.

11 The Kitimat reduction works will be the world's largest aluminum smelter.

Canadian Industry

CANADA'S fortunate position today in a troubled world is largely due to the efforts of the engineering profession, J. A. Morley, director of sales and service of Avro Canada, told The Engineering Institute of Canada at its annual meeting in Vancouver, B. C. As short a time ago as before the last war, he said, who would have predicted the Chalk River atomic-energy development, the exploitation of the Labrador iron-ore fields, with their grids of pipe lines traversing the country, or the realization of the St. Lawrence Seaway project. In British Columbia, Canada is expanding the chemical industry, manufacturing new wood products and their derivatives, and to the north—the giant potential of the Kitimat operations is being developed. See "Canadian Hydro Development," on page 653 of this issue.

According to Mr. Morley, Canada is today one of the world's most powerful industrial nations, its whole economy having changed its status in less than three decades. It used to depend for its livelihood on primary industries—agriculture, fishing, mining, and lumbering. Now it derives its main wealth from the processing of primary products and the manufacturing of a variety of capital and consumer goods. These are necessary for the high standard of living Canada has set up for herself—second only to that of the United States. Canada has become the third most industrialized and trading nation of the world. Since the beginning of World War II, Canada has undergone a phenomenal industrial development, doubling its national production and advancing its standard of living 50 per cent.

He cited the acute shortage of engineering skills brought about by Canada's rapid expansion in practically every phase of technical progress as one of the country's uppermost problems. The Department of Labor, he said, estimates that by 1954 the demand for graduate engineers, at Canada's present industrial tempo, will exceed the supply by about 800 a year. He therefore urged the profession to encourage promising young men to enter engineering.

Among the reasons for the present acute shortage of engineers, he said, is the increasing complexity of modern technology. Aircraft manufacture itself is a good example. In 1943, for every specialized radar and electronic job the aircraft manufacturer needed one technician for every 1000 employees. Today one out of every 24 employees is needed for such a job. At that time one out of 22 employees was an engineering or technically trained man. Today the proportion is one out of eight. The individual parts in an aircraft of World War II were numbered in the low thousands, but a typical bomber of today has nearly 140,000 separate parts, each one of which has to be machined or manufactured to the highest tolerances. It was possible to fill personnel vacancies during the last war from the ranks of housewives, farmers, drug clerks, or filling-station operators. Now these positions have to be manned by skilled personnel. As a result the aircraft industry's hiring policy has been most selective, with an unprecedented demand for engineers, scientists, designers, and skilled craftsmen.

It is alarming to note, he said, that there are only 1717 prospective 1952 engineering graduates currently registered at Canadian universities. According to Department of Labor estimates, there will be only 1411 prospective engineering graduates in 1953.

For example, Mr. Morley said, Avro Canada is seriously affected by this nationwide engineering shortage. To a certain extent the deficit is being made up by training programs. Over and above a wide program of training in skills and engineering processes, the company is planning a broad program of training in administration, supervisory practices, leadership techniques, and the development of creative personnel relationships.

Like most industries, at the moment Avro is concentrating completely on defense work but, he said, Avro could on comparatively short notice convert to peacetime development work and production. Because of the government's dire need for air power and because of the importance air transportation has in the nation's economy, he said, Avro, beyond doubt, is one of the most important industrial concerns in the country. Its products, the Jetliner transport, the CF-100 fighter, and the Orenda engine, are the first of their types and have won worldwide engineering recognition. Mr. Morley pointed out that Avro Canada is a good example of a new Canadian industry, largely self-sufficient, and of tremendous importance not only in the national but also in the international sphere.

Avro, Mr. Morley said, has also fostered many new subsidiary industries including the manufacture of turbines and compressor blades, new heat-resistant light alloys, fuel systems, bearings, gearboxes, and complex aircraft equipment. A network of more than 400 individual companies which are engaged in supplying the Canadian jet program at Malton has been set up. This means that when maximum production is reached about 30,000 individual Canadians will be employed handling various subcontract work, entirely distinct from Avro's staff of some 15,000.

Today for the first time, Mr. Morley declared, as engineers, Canadians can be proud that Canada is featuring Canadian design, not only of aircraft, but of aircraft engines hitherto not produced at all in this country.

There are, unfortunately, few such programs of original design and development undertaken in Canadian manufacturing. Avro Canada is a prime example of Canada's economic expansion and high productivity based upon engineering contribution, he asserted.

Recognizing the need for industry and science to do original work, based on their contribution in two world conflicts, the Canadian government has set up the National Research Council. This has done magnificent work in stimulating independent research work in Canada. Many scientific organizations such as The Engineering Institute of Canada, the Royal Society of Canada, and the Chemical Institute of Canada are also fostering original scientific thinking. Canadian industry as a whole is training its engineering and scientific personnel, and there is no doubt that if this training is properly carried out it could foster creative achievement.

Canadian engineers and scientists, Mr. Morley pointed out, have proved they can produce outstanding work in the industry field. To a certain extent, he said, Canada has already shown

that it can develop its own goods and not be wholly dependent upon imports. Canada has also proved that it can manufacture these goods as effectively as the United States and—what is more—sell them on a competitive basis. Today Canada is producing a large number of commodities or parts formerly imported from the United States. Goods completely produced in Canada and formerly imported range from jet engines to tapered roller bearings, from vinyl sheeting to lace, from two-speed differentials to pyrex nursing bottles, from ethylene glycol to food extracts. As a result of efficient low-cost production, Canada is now exporting to the United States such articles, formerly imported, as noiseless typewriters, stainless-steel equipment, and hollow ware, acetylene black, and baby carriages. Canada is also exporting such manufactured articles as optical goods, electric heating elements, high-carbon bits, and automatic washing machines. In the aviation field there is the De Havilland Beaver which overcame the "Buy American" prejudice, he said. And an even more sensational example is the cobalt bomb for medical therapy.

Canada obviously has a major role to play in the great "Atlantic" triangle, not only to be the traditional interpreter between the United Kingdom and the United States but also to make a real contribution to the partnership in the industrial and general scientific field. Canada, Mr. Morley states, in fulfilling its national role in NATO, the United Nations, and the Colombo Plan as well, must strive toward developing engineering leaders with Canadian attitudes, as well as provide specialists in all the technical skills.

Magnetic-Drive Pump

A MAGNETIC-DRIVE horizontal pump unit, in which liquids are completely isolated and confined to the wetted end, and which presents no rotating connection whatsoever between the driven pump end and the liquid pump end, has been developed and built by Peerless Pump Division, Food Machinery and Chemical Corporation of Los Angeles, Calif. The pump has no rotating seals, no packing, no rotating member between the driver and the driven unit.

The complete sealing-off of the liquid end of the pump is accomplished by use of a true magnetic drive. Power is transmitted from motor to pump by employing the simple principle of matching magnetic fields, from adjacent opposite poles, mounted around the periphery of the driving and driven elements. A circular disk, with 12 to 24 permanent magnets (depending upon pump size) is attached to the rotating motor shaft; this drives a similar-size permanent disk magnet and impeller unit, which is attached to and rotates around a stationary shaft in the liquid end of the pump. No connection exists between the driving magnet and the driven magnet. As a result, a nonmagnetic diaphragm can be, and is employed to completely separate the driven or liquid end of the pump from the driving end of the pump. Because of this separation, and because no rotating connection is maintained between the two ends, liquids being pumped in the liquid end are confined to that end and cannot escape from it. Hence leakage is said to be eliminated completely.

The Peerless magnetic-drive pump is an end-suction horizontal centrifugal-type unit consisting of an electric motor, with a permanent driving magnet assembly attached to the rotating motor shaft. This is the driving end. The driven end, or the liquid end, is composed of the driven magnet and impeller assembly, rotating thrust and radial bearings, a stationary shaft, the pump volute case, with end suction and top discharge. Between the driven end and the driving end, there is a metallic or nonmetallic, nonmagnetic diaphragm, rigidly fixed by two diaphragm supports. Bearing lubrication is effected by liquid being pumped.

At the present time the magnetic-drive pump can be powered by motors, with ratings of 1, $1^1/_2$, and 2 hp, operating at 1760 rpm. Driving motor can be of standard, totally enclosed, or explosionproof design, with any required electrical characteristics. Pump size is $1 \times 2^1/_2 \times 8$ in. only. It is reported that the new design has been exhaustively field-tested on many types of liquids during the period of its three-year development, and units have been installed and successfully operated over this period of time by prominent industrial and process firms with excellent results.

Applications for the magnetic-drive pump are expected to center around processes where a closed system of liquid flow is necessitated, where contamination to the liquid-bearing pump cannot be tolerated, or where leakage of the liquid handled is not permissible. The new design suggests important uses on liquid lines handling hazardous, toxic, or odoriferous pumpable liquids, and for pumping extremely hot or cold liquids as well as those with highly corrosive properties. Fluids handled in actual operation include: Ammonia, liquid chlorine, organic acid, and water.

The liquid end of the magnetic-drive pump can be constructed of suitable materials to meet the requirements of the application. Because of the feature of complete isolation of the liquid being pumped to the wetted end of the pump, capacity and head considerations in the pump's design have been of secondary importance. In the $1 \times 2^1/_2 \times 8$-in. size, pump maximum capacity available is 150 gpm; maximum head is 70 ft. Ratio of head and capacity for any given application will be determined by liquid viscosity, specific gravity, and maximum motor hp as just indicated. Surprisingly good efficiencies are obtained considering the nonconnected type of true magnetic drive employed. The hydraulic characteristics of the pump end were reported to be excellent.

Materials of construction used in the magnetic-drive pump have been Carpenter No. 20, stainless steel, bronze-fitted cast iron, and all bronze. Almost any material can be furnished as long as a nonmagnetic material of stainless steel or plastic can be used for the diaphragm which separates the driving from the driven pump end. Limitations of application are set first, by the 2-hp maximum power applications and second, by the nonhandling of abrasive liquids, as the pump bearings are lubricated by the liquid being pumped. A sufficient number of units have not been built by the manufacturer to bring costs into

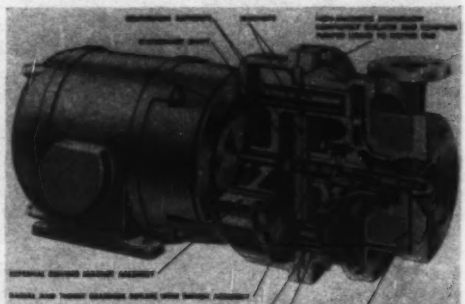

FIG. 1 CUTAWAY VIEW OF MAGNETIC-DRIVE HORIZONTAL PUMP UNIT

competitive relationship with conventional pumps of the same head-capacity characteristics.

Beyond the 2-hp size several 10-hp 3460-rpm units, with 250 psi operating pressure, driving vertical pumps with completely enclosed design are in commercial operation for a specific application, worked out in co-operation with a user. Units of this type can be designed to meet application requirements, if the application warrants the costs involved.

Chemicals From Coal

THE first major investment of private funds in a plant for the production of chemicals from coal by high-pressure hydrogenation has been made by Carbide and Carbon Chemicals Company, a division of Union Carbide and Carbon Corporation, New York, N. Y., with the announcement of Carbide's $11 million coal-hydrogenation chemicals plant at Institute, W. Va.

The far-reaching effects of this new process were explained by the company in the following way:

The coal-hydrogenation process itself is not new. The Germans discovered it as early as 1913 and later used it at costs quite intolerable in our economy to make synthetic motor fuels. But Carbide's concept of using it solely for the production of chemicals is new and probably, revolutionary.

It might be possible to place the entire synthetic chemical industry on a coal raw-material basis, if that ever becomes necessary. This will help allay the fears of those who see in the future the termination of cheap natural gas and petroleum.

Moreover, if the country must sometime depend on synthetic liquid fuels, the engineering advances made by Carbide can be applied to the production of gasoline and Diesel fuel by coal hydrogenation.

But, of most importance is the immediate future, where the coal-hydrogenation process gives promise of brighter days ahead for the hundreds of industries whose production is dependent upon coal chemicals—the plastics, rubber, dyestuffs, perfume, paint, and synthetic-detergents industries, to name a few. For several years, they have been hampered by the limited supply of coal chemicals, and the demand curve has turned sharply upward since World War II. New uses have increased the requirements for some coal-derived chemicals by as much as 25 to 36 per cent per year. The increase in coal-chemicals production as by-products in the steel industry's coke ovens, however, is but three to five per cent per year.

The improved yields per ton of coal made possible by hydrogenation of coal over the average recoveries from all by-product coke ovens are: Naphthalene, 5 to 8 times more; "natural" phenol, 60 to 80 times more; quinoline, 300 to 500 times more; aniline, infinitely greater amounts since it is not isolated commercially from coke-oven by-products. All of these chemicals are vastly important to modern industries.

To change this uneconomical hydrogenation process for making fuel to a profitable method for producing chemicals, the following has been done:

1 Reaction time, using the new process, has been reduced from nearly an hour to a very few minutes.

2 The amount of hydrogen needed to make the process go has been reduced.

3 Product-refining and the primary liquefaction of coal have been simplified to continuous processes.

4 Engineering design has been advanced to minimize breakdowns, operating costs, and labor requirements.

5 The investment required has been reduced materially.

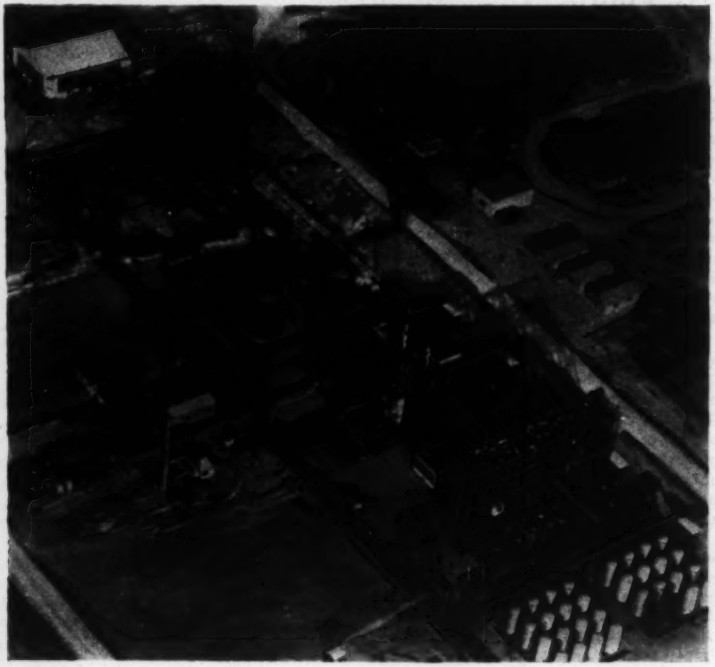

FIG. 2 NEW COAL-HYDROGENATION CHEMICALS UNIT AT THE INSTITUTE, W. VA., PLANT OF CARBIDE AND CARBON CHEMICALS COMPANY

In Carbide's process, coal is crushed to about the size of wheat grains and mixed with recycled oil (recovered from a later stage of the process). The gritty mixture is then pumped into the hydrogenator. Gaseous hydrogen is introduced. The temperature is raised to somewhere between 450 to 550 C and the pressure to 6000 psi. The coal and hydrogen react to form a liquid product under these conditions—this is the chemical manufacturing step. From here on the job is one of separating the products of the reaction.

The mixture then goes to a "hot separator" where the pressure is reduced enough to vaporize the sought-after chemicals. The chemical

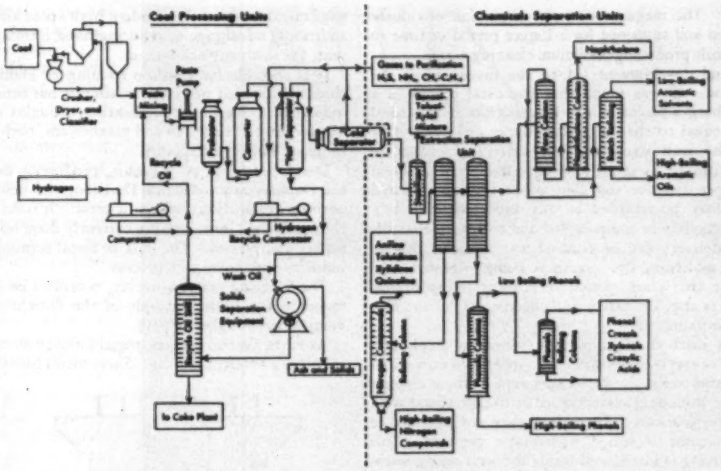

FIG. 3 SIMPLIFIED FLOWSHEET SHOWING CHEMICALS PRODUCTION BY COAL HYDROGENATION

vapor stream is then condensed in a "cold" separator and the mixture of condensed chemicals is broken into three principal fractions: Hydrocarbons, phenols, and nitrogen compounds. Each of these three is broken down still further into individual chemicals and usable chemical mixtures.

The remaining gases are collected and used as follows: The hydrogen is recycled to the process; the other gases are separated and used as fuel, raw materials in chemical manufacture, or sold as bottled gas.

The heavy liquids stream—remaining after vaporization of the chemical products in the hot separator—is treated to remove the ash and unreacted coal, then distilled into two fractions: the recycled oil, which goes back into the hydrogenation process, and a residual oil ultimately to be made into coke.

Some of the chemical products to be expected from this revolutionary process are: Phenol, cresols, aniline, quinoline, naphthalene, toluene. These chemicals have scores of important uses in industry. With the great reservoir of coal resources in the United States, the company said, our chemical-consuming industries can be assured of dependable future supplies of coal chemicals made by this process independent of any other industry's need for coke.

In addition to work already going on in Carbide's laboratories on the separation and refining of familiar coal chemicals from the hydrogenated-coal liquid product, research is well under way for synthesizing entirely new molecules by combining Carbide's extensive list of petroleum and natural-gas-derived intermediates with the newly acquired coal chemicals.

Continued operation of this plant will provide many improvements to be incorporated in larger more economical plants yet to be built.

Vibratory Explosives

THE improvement of water-well yield by the use of vibratory explosives was discussed by Harvey A. Mylander, Mem. ASME, district engineer, Water Supply Analysis, South Pasadena, Calif., before a Hydraulic Division technical session during the 1952 ASME Spring Meeting in Seattle, Wash.

Mr. Mylander pointed out that many wells lose productivity out of all proportion to the decline in the water table. Wells in which the drawdown, or the difference between static and pumping levels increases faster than other wells in the vicinity, might be termed "sick." The reason for this loss of productivity has been the subject of extensive scientific and operational analysis. This drawdown increase causes the pump to operate less efficiently and at a greater pumping lift, resulting in a decrease in water output.

Wells become "sick" from three principal causes: (1) "sanding-off" (a condition in which the productive zones are being buried in the sand), (2) fines in the formation that seal off the coarser layers, and (3) obstructions such as growths, deposits, and incrustations in the perforations and formations.

Incrustation in wells, Mr. Mylander said, is the most prevalent cause of production loss in wells. It is generally described as any clogging or stoppage of the perforated area of a well casing, including the interstices of the adjacent water-bearing formation. It takes the form of a hard, brittle, cement-like acretion due to the usual chemical deposition of hard carbonated waters. This acretion eventually develops into a small irregular mound which completely seals an opening.

A method of removing incrustation, and thereby increasing the production of a well without endangering the structure, was the aim of several practical water-works engineers. A starting point was derived from the oil industry which has used explosives for the initial development and for redevelopment of oil wells, for many years. Investigation also revealed that explosives had been used quite extensively in Southern California for redevelopment of water wells. The practice was called "shooting a well" but was strictly a "hit-or-miss" proposition, as no records of benefits had been kept. Explosives used varied from No. 6 electric detonating caps to Primacord. Further investigations disclosed that a well-servicing firm had on several occasions used Primacord successfully to improve production.

Under supervised tests, 13 wells were shot with Primacord. Two of the wells were damaged; others were so seriously damaged that further use of Primacord was discouraged. Some casings were cut at the fluid level, others split longitudinally, and one was torn at regular intervals.

The benefits obtained were most promising, but the hazards

were too great. The magnitude of the explosion obviously had to be reduced and sustained for a longer period of time to avoid damage while producing maximum cleaning action.

Experiment and development led to the invention of the vibratory method. It was found that the total energy of a series of small charges placed in a well casing can have a total explosive mass equal to that of a line charge and yet not be dangerous to the well structure. An individual charge of high explosive can be so small and separated from adjacent charges by proper distance and time of detonation that the energy release may be retarded to any predetermined rate. Thus small charges may be compounded and so spaced that the rate of energy delivery can be reduced to $^1/_{80,000}$ of that of Primacord. In addition, the casing is being vibrated continuously during the whole period of sequential explosions. It is in these facts that the safety and effectiveness of the new method are to be found.

The perfected method of employing vibratory explosives involves the use of special explosives that are spaced on various leads to correspond with the perforated area. These charges are calculated for minimum submergence or to correspond with the uppermost perforations. Thereafter, they are increased in strength to overcome increased hydrostatic pressure. This prepared firing string is introduced inside the well casing without removing the pump. The clearance between pump and casing is limited; the pump may be lifted 3 or 4 ft within the well so it may be swung from side to side. The pump need not be removed; it is only necessary to shift its position to obtain access for the loaded firing line.

After the firing line is in position, with the explosives opposite the perforated area, the charges are detonated at predetermined intervals by a special firing mechanism. The explosions produce a continuous series of shock waves of relatively long duration that may be used safely in various casings, yet are powerful enough to shatter and dislodge obstructions in the perforations or in the interstices of the surrounding formation.

The gas bubble expands and contracts approximately ten times after each explosion, so that the water is forced out through the perforations and back into the well ten times for each charge. After this cycle is completed the second series of explosions are set off, and so on, until the entire chain is consumed. Thus carefully calculated charges of sufficient force to dislodge or break up incrustation and wash it free in one single operation may be used without removing the pump. After the use of explosives the well is surged with the duty pump until all the residue is pumped out of the well. This seldom requires more than 3 hours and is sometimes completed in 30 min.

Vibratory explosives are currently being used with great success to improve wells by (1) redevelopment, (2) development, and (3) removal of growth.

Experience in treating a large number of wells under varying conditions, Mr. Mylander stated, leads to the conclusion that the method is safe, effective, simple, and inexpensive.

Direct-Acting Hydropress

A NEW type of hydropress, one-tenth the size of conventional presses, yet capable of exerting up to three times the pressures currently used to form thousands of sheet-metal parts used in airplane construction, was unveiled recently by Douglas Aircraft Corporation, Santa Monica, Calif. According to designers, this new production tool will help speed the output and reduce the production cost of airplanes.

The higher pressure makes it possible to form the heavier-gage metals employed in modern high-speed aircraft and has the additional advantage of reducing hand forming by some 50 per cent, the company announced.

It is suitable for shallow forming of aluminum and other sheet metals used not only in aircraft but other metalworking industries. One future application, Douglas said, will be the hot-forming of titanium and magnesium, both coming into use in newer military airplanes.

Developed by O. A. Wheelon, production design engineer of the Douglas Santa Monica Division, the new tool is known as the Wheelon direct hydraulic press. It is designed to perform the type of shallow forming currently done on the Guerin-type rubber pad presses. The bulk of metal forming in the airframe industry is done by this process.

The Wheelon press, however, is said to be a major improvement on the basic principle of the Guerin process, also developed by Douglas in 1935.

As in the Guerin process, metal forming on the Wheelon press involves a single, male die. Sheet-metal blanks are placed over

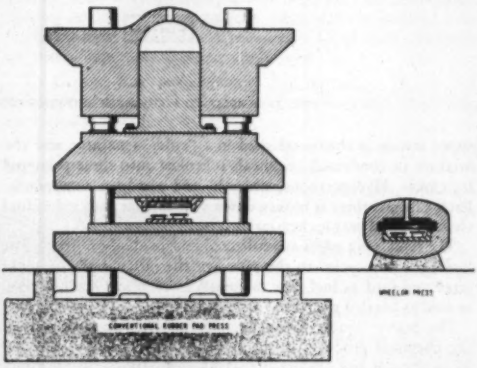

FIG. 4 DIAGRAM SHOWING SIZE COMPARISON BETWEEN CONVENTIONAL RUBBER-PAD PRESS AND NEW WHEELON DIRECT-ACTING HYDRAULIC PRESS

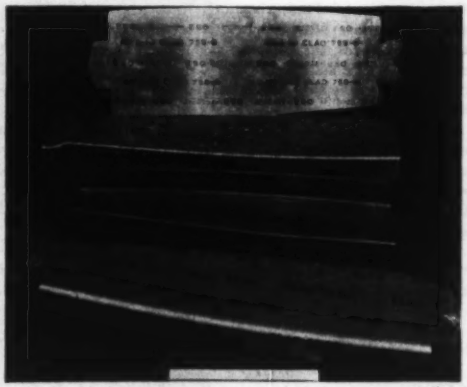

FIG. 5 AN EXAMPLE OF HEAVY-GAGE METAL FORMING ON THE WHEELON DIRECT-ACTING HYDRAULIC PRESS

[*Top to bottom:* (1) The metal blank precut from $^1/_4$-in. 75S aluminum alloy; (2) the Kirksite form block; (3) and (4) bottom and top views of the part formed by the Wheelon press.]

simple inexpensive form blocks and pressure is applied by hydraulically inflating a rubber bag or bladder mounted in the immobile roof of the press.

Unlike the conventional single-acting presses, the Wheelon press has no moving parts except the bed.

While pressures available with the widely used Guerin process usually are in the neighborhood of 1000 to 2500 psi, the Wheelon press permits pressures of 5000 to 10,000 psi.

The pilot model, used with great success in production at the Douglas Santa Monica plant, operates at 5000 psi and applies a total of 2500 tons load on a bed of 20 × 50 in. With this press, aluminum sheet in gages up to 1/4 in. have been formed more perfectly than possible on the huge conventional hydraulic presses which dwarf it in size and cost.

FIG. 6 PILOT MODEL OF THE WHEELON DIRECT-ACTING HYDRAULIC PRESS AS INSTALLED IN THE SANTA MONICA PLANT OF DOUGLAS AIRCRAFT COMPANY

In addition to the superior performance of the Wheelon press, Douglas reports the following advantages:

1 Using present dies, hand forming has been reduced approximately 50 per cent. With a slight change in form blocks, a still greater reduction is possible.

2 The initial cost of the new press is a fraction of the cost of conventional hydraulic presses, making it practical to make numerous installations in various parts of a plant layout to speed production.

3 Since production of the press, itself, is relatively simple it can be placed in the hands of manufacturers quickly. It uses relatively little steel and no critical materials.

4 Because of its low cost and small size, it can be used by small subcontractors to produce many aircraft parts which cannot presently be subcontracted except to major manufacturing establishments.

Douglas started studies for a press of the type developed by Wheelon several years ago and the decision to make a prototype was reached early in 1951. The pilot model was installed in the Santa Monica production department in January of this year.

Douglas announced that the Wheelon press will be manufactured and marketed, under license, by the Verson Allsteel Press Company of Chicago, Ill.

Spectrographic Analysis

NEARLY 100 representatives from 50 railroads in all parts of the United States and Canada attended a two-day symposium May 5 and 6, at Schenectady, N. Y., as guests of the American Locomotive Company. Subject of the symposium was the use of the spectrograph in analyzing Diesel-engine lubrication oil to detect and prevent serious engine trouble. Chairman of the conference was H. R. Sennstrom, Mem. ASME, Alco research and testing engineer, who gave a detailed description of Alco's own spectrographic work over the past several years.

Briefly, the spectrograph, as used in railroad applications, is a device that makes a photographic record of the various metallic elements found in Diesel lubricating oil removed periodically from Diesel-engine crankcases. An analysis of the spectrum photograph results in a quantitative indication of the metallic elements present in the oil sample. Interpretation of the relative quantities of these metallic elements results in an understanding of the specific condition of many engine components, such as pistons, piston rings, cylinder liners, and bearings.

Alco has chosen six elements as indicators of component condition. These are silica (dirt), aluminum (pistons), chromium (chrome-plated liners and water leaks), iron (rings and other parts), copper (bearings), and lead (bearings). When the analysis shows an increase in quantity of any of the indicator elements, the locomotive Diesel engine is subjected to whatever maintenance may be indicated as necessary.

At present Alco is testing lube-oil samples from 850 locomotives twice a month, in co-operation with the more than 20 railroads involved. In addition, at least 7 major railroads have either in operation or on order a complete spectrographic testing outfit for preparing and testing their own oil samples.

During the past year, improved laboratory and sampling techniques, combined with more accurate interpretation, have increased the efficiency of spectrographic analysis to the point where a majority of the participating railroads report considerable savings in maintenance, repair, and prevention of costly breakdowns.

Many railroads are exploring possible extension of overhaul periods through use of spectrographic analysis. In addition, this method has been effective in reducing outages formerly required to determine extent of engine wear by visual inspection. However, it was pointed out that spectrographic analysis is not yet intended to take the place of present inspections and maintenance, but only to supplement them.

A. C. Mengel, chief chemical engineer of Alco, opened the symposium with a historic account of the development of spectrographic methods, following which a technical account of Alco's present laboratory and field methods was given by

L. L. Kathan, Alco chemical engineer. One of the points made by Mr. Sennstrom was that spectrographic analysis indicated that some lube oils created a condition where engine wear rates were lower than for other oils.

Among the many railroad representatives favoring the continued use of spectrographic analysis for Diesel-engine maintenance control were: V. E. Amspacher, chief chemist of Pennsylvania Railroad; Fay Thomas, assistant to general superintendent of equipment, New York Central; R. W. Seniff, Mem. ASME, engineer of tests, Baltimore & Ohio; W. E. Lasky, engineer of tests, Gulf, Mobile & Ohio; C. C. Mugford, assistant engineer of tests, Southern Pacific; Stanley Crane, engineer of tests, Southern Railroad; W. F. Sinclair, engineer of Diesel equipment, Canadian Pacific; and Kenneth Cartwright, Mem. ASME, general mechanical superintendent, New Haven Railroad.

Mr. Seniff of the B.&O. summarized the general conclusions of the two-day symposium by saying that while spectrographic analysis had already proved itself by the amazing progress made during the past year, the railroads and manufacturers must capitalize on the use of spectrography as a vital tool which brings good dividends if accurately and intelligently used. Mr. Seniff proposed, as a resolution, that the railroads and manufacturers form a committee headed by Mr. Amspacher of the Pennsylvania Railroad, to determine standard laboratory techniques and tolerances for formal submission to the American Society for Testing Materials, which would then establish these spectrographic standards for the railroad and locomotive industries.

Representatives attending the symposium were taken on a tour of inspection of Alco's spectrographic laboratory. Other groups toured General Electric's spectrographic laboratory and Knolls Research Center.

Betatron Inspection

THREE 24-million-volt betatrons, the first ever built for industrial operation, are now being used in Eastern and Midwestern steel foundries to help speed the production of vital armor-steel castings required in the Army's battle-tank program.

Powerful enough to penetrate 7 to 9 in. of armor steel in little more than a minute, the new x-ray giants greatly speed and improve inspection techniques formerly requiring hours and days in some cases, it was reported by F. Kermit Donaldson, executive vice-president, Steel Founders' Society of America.

The three units are being operated for the Army in armor-producing plants of General Steel Castings Corporation at Granite City, Ill., and Eddystone, Pa., and by Continental Foundry & Machine Company, at East Chicago, Ind. Both companies currently are important producers of heavy armor parts for tanks. A fourth installation is under way at the Continental plant in Coraopolis, Pa.

Housed in specially designed radiation-proof buildings, each of the units is estimated to have cost approximately $225,000. All have been built for the Army Ordnance Corps under supervision of the U. S. Army Corps of Engineers.

Previously used only in physics laboratories in atom-smashing experiments, for medical research, and in cosmic-ray studies, the betatron now is recognized as the most advanced scientific tool for nondestructive testing of heavy steel castings, according to Mr. Donaldson. Applied to armour production, it permits fast, positive inspection and quality-control procedures, providing exceedingly sharp and revealing x-ray film records through metal sections ranging up to 24 in. in thickness.

In operation, he explained, the betatron builds up tremendous energy, developing and controlling the action of high-velocity streams of electrons producing x-rays which are focused on the cast-steel parts to be filmed for inspection.

Operating on the same fundamental principles as those applying to an electric transformer, the betatron consists of a primary coil through which high-voltage electric current is passed to energize a huge electromagnet; and a secondary, comprising a large ring-shaped vacuum tube known as a "doughnut."

Whirling electrons produced from a heated filament circle the doughnut until the whirling action attains a velocity closely approaching the speed of light as the result of the acceleration produced by the electromagnetic field. Then, when the electrons have reached their energy peak of 24 million volts—whirling around the vacuum tube approximately 150,000 times every 0.004 sec—the magnetic field is expanded and the electrons stream from their so-called equilibrium path in the doughnut to fall upon a platinum "target." Ensuing electronic bombardment of the target material produces x rays, which in turn are focused on the steel casting subject to inspection via subsequent examination of the resulting fast film exposure.

In point of size, the betatrons comprise the largest inspection instruments ever adapted to foundry practice. In each of the General Steel Castings Corporation plant installations, for example, suspension of the towering betatron requires a 7½ ton crane, which provides for lateral and transverse movement. A telescopic arm between the crane and the betatron allows vertical positioning, and the x-ray machine also may be tilted and rotated to focus rays on the desired section of the casting under inspection. Another overhead crane, of 20-ton capacity, is required for positioning the heavy armor parts.

For protection against radiation, the installations are housed in specially constructed, windowless buildings with thick double walls of concrete slab spaced 10 ft apart and filled with sand to a height of 20 ft.

Complicated safety measures are provided to assure the full protection of personnel at all times.

Low-Power Nuclear Reactor

AN INEXPENSIVE, low-power nuclear reactor, unique in that it is submerged in water to protect operators from radiation, has been developed by scientists at Oak Ridge National Laboratory, Oak Ridge, Tenn., which is operated for the Commission by the Carbide and Carbon Chemicals Company, a division of the Union Carbide and Carbon Corporation.

The reactor is the central feature of a bulk shield-testing facility which is used for experiments to aid development of improved reactor shields. The facility is popularly known as the "swimming pool," since the reactor is submerged in a pool of water 20 ft deep, 20 ft wide, and 40 ft long, in which it can be moved about. The reactor became "critical" on December 17, 1950, and was placed in operation soon afterward.

The entire facility was constructed for less than $250,000 exclusive of fuel. Of this amount, the reactor core itself cost only $58,400, the rest of the cost being for concrete work, the building, and auxiliary equipment. The reactor uses fuel elements which had already been designed for the materials-testing reactor, a large unit which went into operation recently in Idaho (MECHANICAL ENGINEERING, June, 1952, page 494).

This swimming-pool reactor has a continuous full-load power rating of 10 kw, at which it produces a maximum flux, or neutron density, of approximately 100 billion thermal neutrons per sq cm per sec.

This reactor has proved to be an economical and safe producer of radiation for certain purposes. For these reasons, as well as low cost, simplicity, and performance, it is one of several types of reactors which might be suitable for use at schools and other research and training institutions. The purpose best served by each type differs and the estimated costs vary considerably.

The reactor is an assembly of movable fuel elements placed on end in an aluminum grid. It is suspended by an aluminum framework from what is called the reactor bridge, which spans the pool. The bridge rests on wheels fitted to rails along either side of the pool, so that the reactor can be moved along a center line the length of the pool.

Similarly, an instrument bridge spans the pool and operates on the rails. A steel framework attached to the movable mechanism of this bridge extends nearly to the bottom of the pool. Using a carriage that slides up and down on the framework, operators can place test instruments at any point in the pool.

A useful feature of the facility is an aluminum gate, 12 ft high and 21 ft long, 10 ft from the south end of the 130,000-gal pool. When the reactor is moved to this end of the pool, the gate can be lowered and the greater area of the pool can be blocked off and pumped dry. Thus some repairs and adjustments are facilitated, and instruments and shielding samples can be placed easily in desired spots, with personnel meanwhile protected from radiation.

Shielding measurements on samples can be made also in the open air, with samples placed near the dry side of the gate and the reactor moved close to the other side of the gate.

Centered on the bottom surface of the pool is a well 14 feet square and 5 feet deep. This well is filled with removable blocks of high-density concrete, giving part of the pool an adjustable floor level for more flexibility in the placement of shielding samples and instruments.

The reactor has a variety of potential uses in addition to its principal roles as an aid in the testing of shields. It enables students and other investigators to perform critical experiments, study neutron distribution and, within limits, study the effects on reactor operation of various patterns of arrangement of the fuel elements.

Steel Studies

STUDIES on how to overcome the porosity and brittleness produced in steel by hydrogen are described in two Government research reports now available to the public, the Office of Technical Services, U. S. Department of Commerce, announced.

Hydrogen gas present in steel has long been known to cause porosity and brittleness. To overcome this difficulty the Office of Naval Research wanted to find out first how much hydrogen can be tolerated in steel before the porosity and brittleness became objectionable. This, in turn, called for development of quick techniques for analyzing the hydrogen content in steel.

Scientists at Massachusetts Institute of Technology, to whom this problem was assigned, came up with a commercially practical technique—that is, a procedure for analyzing steel for hydrogen that takes only 15 minutes and is as simple as standard tests for carbon, sulphur, or manganese content. "The Analysis and Sampling of Liquid Steel for Hydrogen" is the title of the report which describes this development. With the analytical apparatus described, precision of 1 part per million for a 2-gram sample is obtainable.

To overcome the difficulty of keeping the liquid-steel sample so that the analytical results would be a true picture of the sample's hydrogen content, the M.I.T. scientists developed an induction-heated apparatus in which the liquid metal could be kept under a controlled atmosphere and from which samples could be taken without exposure of the liquid metal to air. This development is also described in the report. It was found that the new analytical technique and sampling procedure together are very well-suited to process control of hydrogen in commercial melting furnaces.

Using the foregoing analytical and sampling techniques for hydrogen content, another group of M.I.T. scientists studied the effect of different hydrogen contents on the mechanical properties of steel and presented some speculations as to the mechanism by which the hydrogen brings these changes about. The report in which their work is described is entitled "Hydrogen Embrittlement of SAE 1020 Steel."

Pb 105103, "The Analysis and Sampling of Liquid Steel for Hydrogen," 96 pages including photos, line drawings, and graphs, sells for $4.25 in microfilm and $12.50 in photostat form.

Pb 1052290, "Hydrogen Embrittlement of SAE 1020 Steel," 30 pages, including line drawings and graphs, sells for $3.75 in photostat and $2 in microfilm form.

Orders should be addressed to the Library of Congress Photoduplication Service, Publication Board Project, Washington 25, D. C. Enclose check or money order payable to the Librarian of Congress.

Rotary Drilling

EXPERIENCE gained during operation in the experimental oil-shale mine at Rifle, Colo., of a hydraulically operated drill designed by Bureau of Mines engineers, has shown that rotary drilling of vertical blast holes in oil shale is less expensive than percussion drilling, according to a Bureau of Mines report.

It had been felt for some time that rotary drilling would have definite advantages in drilling oil shale if a suitable drill could be developed. Tests with standard electrically driven rotary coal drills had shown that they lack the flexibility required for satisfactory drilling of oil shale, because the resistance to drilling the shale varies greatly with its richness. A compressed-air-driven rotary drill also gave excessive bit breakage.

Using an available tractor as a mount, Bureau engineers designed a hydraulically operated drill which permitted speed, torque, and thrust to be varied widely. Details of the construction of the drill are given in the report. The drill motor can operate at any speed up to 1050 rpm, and the feed motor can deliver any desired thrust up to 4000 lb. In general, the report says, low speed and high thrust give the longest drill life while high thrust gives the highest drilling rates.

When operated at 400 rpm with a thrust of 3700 lb a 2-in. bit tested at Rifle drilled 184 ft between sharpenings at the average rate of 69 ipm. The average rate of drilling with percussion drills at the experimental mine is 20 ipm. These figures refer to the drilling of vertical holes, as the test drill has not yet been used in horizontal drilling enough to permit definite conclusions to be drawn.

Besides cutting the labor cost of drilling in half, the report states, experience with the test drill shows a major reduction in the cost of bits and drill steel. With percussion drilling, these items cost about 2.8 cents per ft of 2-in. hole at Rifle. While the comparable cost of rotary drilling cannot be given accurately because the bits tested were handmade for the job, it is concluded that they would be less than 2 cents per ft of 2-in. hole if bits were purchased in large quantities.

According to the report, similar savings will be experienced

in horizontal drilling. Although the drill was designed as a research rather than a production tool, many of its features could be incorporated in a commercial multiple-drill rig, the report indicates.

In addition, the report observes, longer holes can be drilled efficiently with rotary than with percussion drills. This means that more shale can be blasted for each drilling operation, thus further reducing costs. Still another advantage seen for rotary drills is a reduction in capital costs for drilling equipment, as less than half as many rotary-drill outfits as percussion-drill outfits would be required for a given rate of production.

A free copy of Report of Investigations 4864, "Development of a Rotary Test Drill," may be obtained from the Bureau of Mines, Publications Distribution Section, 4800 Forbes St., Pittsburgh 13, Pa.

Gas Purification

DEVELOPMENT of a new and cheaper method of removing carbon dioxide from synthesis gas was announced by the Synthetic Liquid Fuels Research Branch of the Bureau of Mines at Bruceton, Pa.

Synthesis gas is a mixture of carbon monoxide and hydrogen, obtained through the reaction of oxygen and steam with coal. Removal of carbon dioxide from the gas is a necessary step in the production of synthetic liquid fuels from coal by the gas-synthesis process. This is one way of producing oil from coal and oil shale being studied by the Bureau in its continuing synthetic-liquid-fuels research program.

The new method employs a hot, concentrated solution of potassium carbonate to absorb the carbon dioxide. Absorption occurs at pressures of 300 to 600 psi, which are used in the gas-synthesis process.

The carbonate solution is regenerated by pressure letdown and steam stripping at substantially the same temperature used in the absorption step. This, it was explained, eliminates the need for heat-exchange treatment, used in the conventional method, and reduces the amount of steam consumed in the process.

As synthesis gas is the major cost item in producing synthetic liquid fuels from coal by the gas-synthesis process, any improvement that reduces the expense of purifying the gas is a definite advance toward the day when production of oil from coal on a commercial scale will begin.

It is expected that the new method will also be used in other processes, notably the production of synthetic ammonia from either coal or natural gas. Because of the large volumes of carbon dioxide that must be eliminated in synthetic-ammonia production, Bureau technologists feel that the improved process should be very valuable to this rapidly expanding industry.

The laboratory work and pilot plant tests that led to the development of the improved method formed an integral part of the Bureau's over-all synthetic-liquid-fuels program, and the process has been filed for patent in the name of the United States Government.

Engine Preheater

ENGINE preheating equipment which makes it possible to start Diesel or gasoline engines under severest arctic conditions in hitherto unattained short time, is now in production, for the armed forces or other uses, by Stewart-Warner Corporation, Chicago, Ill.

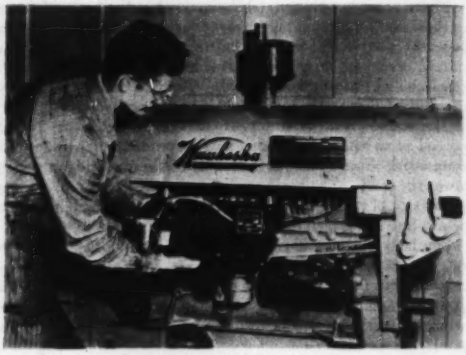

FIG. 7 COMBUSTION-TYPE HOT-AIR UNIT AS ADAPTED FOR ENGINE PREHEATING

The equipment was described as adaptable to vehicles; for use on ships having Diesels on decks or otherwise exposed; on engine-driven generators or compressors; on engines of cranes, winches, or booms used for cargo handling on docks or materials handling elsewhere, or, in any outdoor location where ambient temperatures dip below "practical" engine-starting temperatures.

Typical of the problems of engine starting in extreme cold are those encountered in quick engine starting at —65 F. Here, the following three basic objectives must be achieved: Resistance to cranking power required must be minimized to permit the engine starter to turn the engine fast enough for reliable starting in minimum time; since engine fuels are difficult to ignite at —65 F, some method must be provided which will augment the normal engine ignition system during starting periods; lubricating oil must be heated sufficiently to promote the circulation and to provide normal lubrication when the engine is started.

Heating of the interior of the engine, warming the congealed oil on the friction parts of the engine, is accomplished, with the Stewart-Warner system, by circulation of clean air, heated to approximately 400 F, through the engine. Reports indicate that tests on systems of this type have resulted in reduction of resistance to cranking power sufficient to enable easy cranking in from 10 to 20 min heating time.

Introduction of heated air into the engine air-induction system is accomplished with the Stewart-Warner preheater. This aids combustion by warming the air and fuel vapor while preventing condensation of the fuel on cold manifold and combustion-chamber walls. Tests conducted on engines using heated induction air have resulted in starts after only a few revolutions of the engine, thus imposing a minimum load on battery charge—a very important consideration, since battery output is very low at —65 F.

Lubricating oil may be heated by means of a heat exchanger built into or around the oil sump. A successful method used in Stewart-Warner tests involves finned tubing routed through the oil sump, with 400 F air, or the combustion heater exhaust, routed through the sump exchanger to heat the oil.

Using a standard vehicle heater (Stewart-Warner Model 978) with a normal delivery of 20,000 Btu per hr, a General Motors 6-cylinder, 2-cycle Diesel engine weighing over 3000 lb has been started with less than one minute's cranking at 60 to 90 rpm, at temperatures from —25 to —65 F, using SAE 10-W oil. This engine was preheated from 25 to 75 min. Cranking power inputs ranged from 6000 to 10,000 watts.

The preheating systems, although developed in close cooperation with military agencies, are expected to find wide usage in many civilian fields, the company said. Expansion of Diesel power into the highway trucking field is expected to provide a sizable market for the experiment, as is Diesel equipment used by construction and highway contractors. Because the heaters employed, in the case of trucks or other vehicles, are engine-mounted although independently operated, the heat output, after cold weather starting has been accomplished, can be diverted to personnel heating, defrosting, cargo heating, by use of simple diversion dampers, eliminating need for other heating equipment on the vehicle.

Stretch-Flattening Machine

THE completion of a stretch-flattening machine that can process in volume integrally stiffened extruded skin sections with flatness tolerances well within the precision requirements of present-day aircraft design, has been announced by Longren Aircraft Company, Torrance, Calif.

Ever since the advent of high-speed, highly stressed airplanes, demanding in turn thinner wings and stronger external fuselage sections, each with optimum aerodynamic surfaces, aircraft design engineers have been appraising the possibility of using integrally stiffened skin structures to offset structural complexity, reduce weight and volume requirements, and add strength. To date, integrally stiffened skin sections have been machined from flat billet stock to prove their feasibility, but costs and material wastes using this method were prohibitive. A few experimental sections were produced by forging, casting, and rolling, but such methods have left much to be desired in the way of practical results.

The stretch-flattening machine, as developed by Longren, works as follows:

When the aluminum-alloy integrally stiffened extruded tubular sections are received in the Longren shops, they are first split longitudinally, roughly flattened, then heat-treated.

In flattening, the heat-treated integrally stiffened sections are

FIG. 8 ALUMINUM-ALLOY INTEGRALLY STIFFENED EXTRUDED TUBULAR SECTION IS SHOWN AFTER HEAT-TREATMENT BEFORE ROLLING AND STRETCH

FIG. 9 ROLL STRETCH-FLATTENING MACHINE IN ACTION

end-mounted between mechanical V-clamps in the tension flattening machine. One of the V-clamps remains fixed while the other is mounted on a hydraulic piston. Using hydraulic pressure, the entire sheet is then placed under tension to a point just below the yield strength of the material.

After this initial tensioning, the traveling carriage with its three rigidly mounted displacement rolls is started along the sheet from the stationary jaw end. The movable chuck automatically takes up the slack of elongation and maintains even tension. The lower rolls of the carriage are sectional in design so that the tops of the extruded stiffeners rest firmly against an inner roll, while the outer rolls press firmly against the sheet area between the stiffeners. The upper roll is solid and smooth, and presses against what will be the external side of the flattened section.

As the traveling carriage progresses along the sheet, the material feeds over the first lower roll, then angles slightly downward under the upper center roll. Beyond the upper center roll, it angles upward again, then reverts to the plane of tension between the end-clamping jaws after leaving the last displacement roll.

As the material passes under the center roll, the greatest elongation takes place. At this point, the material is tensioned slightly beyond its yield point, and work-hardening takes place. On passing the last displacement roll, the material stabilizes to a permanently flattened condition.

To further assure this passive condition, the angles of displacement through the rolls are carefully balanced out, thus assuring equal stress relief in both the sheet and the extruded stiffeners. After the sheets have been flattened to permissible tolerances, they can be contoured as desired using conventional stretch-press equipment.

Weather Research

TERMINATION, on June 30, of Project Cirrus, joint weather-research program of the Signal Corps and Office of Naval Research in consultation with the G-E Research Laboratory, was announced recently by General Electric Company, Schenectady, N. Y.

The program has been carried out for the past five years by scientists of the laboratory under a contract sponsored by the two services. Aircraft and crews needed in some experiments have been furnished by the Air Force.

Early exploratory phases of cloud seeding and allied research concerned with the physics of clouds, called for under Project Cirrus, are now virtually complete, according to Dr. C. G. Suits, G-E vice-president and director of research.

According to the G-E official, the work of Dr. Irving Langmuir, Dr. Vincent J. Schaefer, and Dr. Bernard Vonnegut in this field has initiated a new science of experimental meteorology and has provided a tremendous stimulus to scientific investigations in this most important subject.

It is not easy to predict ultimate results, he said, but it is certain that the pioneering and spectacular work of these scientists in cloud physics, cloud seeding, and weather modification will eventually have a profound influence on all of us. Rainmaking, which has been popularly identified with this project, is in reality only one aspect of the very broad subject of experimental meteorology.

Wide interest in experimental weather study has been aroused by work of the project, according to Dr. Suits. So many other research projects have been stimulated by the pioneering efforts of the scientists working under Project Cirrus that continued progress in the search for new basic knowledge of weather phenomena "seems assured," he said.

Active research in the field is being carried on in many foreign countries. Among these, he said, are Canada, Cuba, Peru, England, France, Switzerland, Israel, Algeria, Tanganyika, Union of South Africa, Formosa, Japan, and Australia.

According to current estimates, some 350 million acres in the United States west of the Mississippi are subject to cloud seeding by commercial operators, he added.

Because of the widespread interest in experimental meteorology, more emphasis is now being placed on consulting activities by Dr. Langmuir and Dr. Schaefer, according to the G-E official. In addition, there are many problems connected with cloud physics which are being studied by Dr. Schaefer.

It is expected that this laboratory work in cloud physics will be continued, in order to learn more about the fundamental nature of the phenomena involved.

The program leading to Project Cirrus began in the summer of 1946. Dr. Schaefer, who had long been interested in snowflakes as a hobby and who had, during World War II, worked on icing of airplanes, sought to find what caused snow crystals to form in the atmosphere.

Inside a home freezer, at a temperature of about 0.F, he made a cloud of tiny water droplets, which did not freeze despite the low temperature, well below the commonly accepted freezing point of water at 32 F.

Although he tried adding many materials he could not get snow crystals to form. Then, one hot July day, in order to keep the box sufficiently cool, he introduced some dry ice. The cloud was immediately converted into one of minute ice crystals.

According to Dr. Schaefer, it is not the dry ice itself but rather its cooling effect that causes the transformation from water droplets to ice crystals.

On Nov. 13, from an airplane flying at 14,000 ft over Mt. Greylock in western Massachusetts, Dr. Schaefer applied this discovery out of doors. He dropped dry ice pellets on a natural supercooled cloud and saw it turn to snow. None reached the ground, however, because it melted and evaporated as it passed through warmer layers some 3000 ft below.

A little later, Dr. Bernard Vonnegut, another G-E scientist, found that crystals of silver iodide, which have the same arrangement of atoms as ice crystals, act as nuclei in clouds and cause supercooled water droplets to freeze on them. All these experiments were guided by the theoretical work of Dr. Irving Langmuir.

A third experimental technique for modifying cloud formation is that of water seeding developed by Dr. Langmuir. Water drops, introduced into certain types of cumulus clouds, grow and break up in a continuous chain reaction, which effect serves to reorganize tiny water droplets composing the cloud into raindrops large enough to fall. This technique recently was reported used very successfully in Australia by the government of that country.

Project Cirrus was established in March, 1947. Actual flying and seeding was done by an operations group, consisting entirely of men from the services, while the General Electric scientists analyzed the data and advised on field work.

Dr. Suits predicted that the pioneering work of General Electric Company scientists in weather modification will eventually have a profound effect on all of us.

Let's Take the Strait Jacket Off Technical Style

(Continued from page 650)

writing! His technical instructors and professional magazines have indoctrinated him by precept and example that common usage requires this style.

INDUSTRY TAKES CORRECTIVE STEPS

Business and industry generally realize the huge investment they have in communication—and they have taken steps to improve their employees' writing. Books like Rudolph Flesch's, "The Art of Plain Talk," have had an enormous impact. Many companies have hired consultants to help their employees write concisely and directly; others offer courses on various types of writing such as the business letter and the report.

The engineering profession, dedicated as it is to saving men, materials, and money, could appropriately take the lead in this effort to make a swift transition from the age of the quill pen to the era of the electric typewriter. It can take a long step forward by casting off the strait jacket of obsolete custom, by setting an example of direct forthright expression for young engineering students, and by trying to sound like human beings instead of the "it-has-been-the-senior-author's-privilege-to-discuss-his-views-with-Professor-Doakes" kind of stuffed shirts.

APPLY ENGINEERING PRINCIPLES

In summation, it is the opinion of the writer that it is the appropriate moment to re-examine the style of writing which might most effectively be used by members of the engineering profession. It is also the writer's belief that a long-lasting tradition about the inappropriateness of the active voice and the personal pronoun for technical writing has been making for a great deal of inefficiency. This kind of writing has been exemplified in the past by numerous national publications. It would appear that an application of the principles of engineering to this problem would be beneficial, and it would seem the result might be that such style would be eliminated.

In other words, I think it's about time we stop insisting on impersonal style for engineers. I think that our national publications could set a good example in breaking this strait jacket. After all, the engineer wants efficiency and a "common-sense" approach in his professional work. Why not encourage him to apply this practical method to his writing? If he does, he'll save time, money, material—and his reader's temper.

ASME TECHNICAL DIGEST

Substance in Brief of Papers Presented at ASME Meetings

Training Power-Plant Personnel

Selecting and Training Personnel for Centralized Control Power Station, by F. E. Nicoson, Public Service Company of Indiana, Inc., Noblesville, Ind. 1952 ASME Semi-Annual Meeting paper No. 52—SA-48 (mimeographed).

THIS paper outlines a plan for organizing and training the personnel for the operation and maintenance of a centralized-control electric generating station. Due to the style of construction of the newer stations, the employees are required to have a knowledge of all three phases of operation, namely, turbine, boiler, and electrical, whereas in the older-type stations the employee usually specialized in one of the three. Since there are few available employees with general experience, it becomes necessary to provide a well-rounded training program to develop the desired organization and to strengthen the inexperienced phase of the individual.

Training an Operating Group for a Second Generating Station, by J. D. Williamson, Jun. ASME, The Dayton Power and Light Company, Dayton, Ohio. 1952 ASME Semi-Annual Meeting paper No. 52—SA-47 (mimeographed).

HOW one utility assembled and trained the necessary personnel for a second generating station from a limited number of employees is discussed. The method of selection, the preparation of job descriptions and rates, and the final schooling in the new station equipment prior to the start-up is given.

Fourteen months of preparation, and close co-operation with union representatives, the paper states, has paid off in an able organization and a minimum of errors.

Training Power-Plant Employees on the American Gas and Electric System, by Albert H. Beiler and John E. Geue, American Gas and Electric Service Corporation, New York, N. Y. 1952 ASME Semi-Annual Meeting paper No. 52—SA-45 (mimeographed).

ORGANIZED training of power-plant employees is a necessity because of the following:

1 Men must be trained quickly and well because of unprecedented expansion in the electric-utility industry.

2 With concentration of large amounts of power in fewer units and in fewer hands, the consequences of error become increasingly serious. The increased responsibilities thus imposed demand more thorough and better-organized training than heretofore.

3 Modern power-plant design demands quicker response by operators to abnormalities. Speed of response is improved by thorough training and instruction.

4 Good training improves the morale of the operators and fosters good employer-employee relations.

5 Where it is impractical to hold classes, operating instructions should be mostly self-instructing.

It is pointed out that: (1) The preparation of operating instructions is a full-time job that requires competent pedagogical, engineering, artistic, and drafting personnel, and (2) since the very large investment in power-generation facilities may be endangered by misoperation, the expense of a good training program is completely justified.

Training of Operating Personnel for Power Plants With Centralized Control, by D. F. Steinke, director, The Dow Chemical Company, Midland, Mich. 1952 ASME Semi-Annual Meeting paper No. 52—SA-46 (mimeographed).

THIS paper covers the following: (1) Objectives of the educational program; (2) the problems created by centralized control and expansion and history; (3) the development of the program—courses, union agreement, and equipment; (4) why the program was expanded to include all personnel and changes from the first policy developed; (5) the curriculum and courses; (6) standardization, grading, and recognition; (7) the development of textbooks and multisensory aids, union agreements, job progression; (8) training techniques; (9) help and reciprocation in developing the program—functions that evolved from this educational program.

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Production Engineering

The Economics and Philosophy of Choosing New Machinery and Equipment, by D. M. Pattison, The Warner & Swasey Company, Cleveland, Ohio. 1952 ASME Semi-Annual Meeting paper No. 52—SA-50 (mimeographed).

THE demands being made on the capital-goods industries and their customers, due to our defense program, have pushed the whole subject of dynamic equipment policies definitely into the background.

Since July 1, 1950, it has been a question of how soon and how much, regardless of cost. Many pieces of equipment have been continued in service—not scrapped; many operations are being performed on machines of improper size or type; old methods or processes have been continued because of the inability to obtain new proper equipment. And so it goes—defense, like war, is wasteful.

This paper aims to restate and reexamine the economics and philosophy of choosing new machinery and equipment; to focus thinking and forward-planning so as to be fully prepared by the end of the defense effort to re-establish a perspective on efficient operations and to reactivate equipment policies.

The paper concentrates on the practical application of a proper replacement program, discusses some of the basic underlying principles, and refers to sources of additional information which will provide a more detailed and comprehensive background.

Analysis of Developments in Automation, by C. J. Jacoby, 3rd, Harvard University, Boston, Mass. 1952 ASME Semi-Annual Meeting paper No. 52—SA-49 (mimeographed).

UNTIL the recent development and construction of a program control for machine tools, automation was economical only for the high volume production of one product. This control makes automaticity possible without the sacrifice of the flexibility of general-purpose machinery. Future developments through the use of this control principle are foreseen as leading to the extension of automation to the plant producing moderate volume of several products of the same general size and type and using the same sequence of operations.

Programming—the direction of a mechanism through a desired operating cycle—is the term given to a development which makes possible automatically controlled general-purpose machines.

Most machine-tool operations still utilize the human mind to perform the programming function, whether the operator reads a blueprint and determines methods, feeds, speeds, etc., or is aided by instruction sheets and machine setups performed by others.

Through the use of mechanical aids such as templates, cams, limit switches, and the like, the programming of the cutting-tool travel does not have to be done by the human operator. The mechanical aid takes over that function, but the operator must still be there to load, set feeds and speeds, and to set up the mechanical aids. The use of such mechanical aids has been developed in the transfer-type machine so that no human programming must be done at all. However, the programming is built into the machine and the program can not be changed to produce a different product without substantial time being taken to change the controlling elements.

The lack of flexibility in such a machine can be overcome by utilizing programming information from some external source, which is fed into the machine tool to control the operation automatically. The same machine could be utilized to automatically produce a different part, by merely changing the inflow of information. This concept of external programming has been used before in other applications—the Jaquard loom, or the old-fashioned player piano in which a wide roll of punched tape controls the keys of the piano to produce the desired result—music.

Programming controls are not the one answer to automation, or even to automaticity. Electric circuits utilizing limit switches and mechanical interlocks will always have a big part to play. But where the flexibility of operations is necessary, the programming control will come to play an increasingly important role—both in application to general-purpose machinery and to flexible, but more specialized, machinery used in producing a line of products.

The Shear-Angle Relationship in Metal Cutting, by M. C. Shaw, Mem. ASME, N. H. Cook, and I. Finnie, Massachusetts Institute of Technology, Cambridge, Mass. 1952 ASME Semi-Annual Meeting paper No. 52—SA-51 (mimeographed).

THE several analytical solutions that have been presented for the shear angle in metal cutting are briefly described and the underlying assumptions critically discussed. The friction process that obtains in cutting is considered in detail and it is shown that a variable restraint and accompanying variation in the effective hardness of the metal cut constitutes a major difference between ordinary friction and that between chip and tool. This variation in relative restraint and effective hardness accounts for the wide variation of coefficient of friction with rake angle observed in metal cutting. Furthermore, this variable restraint constitutes a significant connecting link between shear and friction processes, and is responsible for the shear plane not being in the direction of maximum shear stress in the general case. These new concepts are incorporated with the best features of previous work, and an equation is presented, in which the angle between the shear plane and direction of maximum shear stress figures prominently. The new equation for shear angle is illustrated and discussed with the aid of experimental cutting data covering a wide range of operating conditions.

Process Industries

The Hydrodynamic Resistance of Particles, by Nicholas Shoumatoff, Jun. ASME, West Virginia Pulp & Paper Company, New York, N. Y. 1952 ASME Semi-Annual Meeting paper No. 52—SA-42 (mimeographed).

MANY attempts have been made to describe the hydrodynamic behavior of massed particles by a single equation with minimum empiricism and maximum generality. In this study the same objectives are sought, but at each step of the analysis the apparently necessary limits of generality are critically examined and emphasized. At the outset it appears necessary to forego a completely analytical solution because of the severe restrictions that this involves in the geometrical model. However, a considerable reduction in the degree of empiricism is obtained from the assumption of hydrodynamic continuity between massed and isolated particles. Pursuing this hypothesis, the resistance equations are developed in commensurate terms for both massed and isolated particles, and investigation is made of the conditions under which transformation between the two can be accomplished. Experimental data are used to verify the results of this comparison and to evaluate the residual unknowns for the important class of phenomena when the particles are uniform spheres. A general form of the resistance equation is set up, applicable to both isolated and massed particles, containing four empirical constants of unequal generality. The values of these

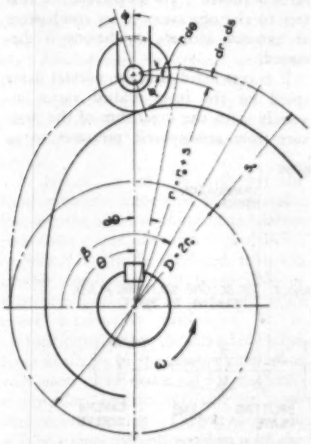
constants must be separately determined and substituted into the equation when the conditions are beyond the scope of the experimental evaluation presented in the paper.

Machine Design

Pressure Angles in Cam Roller Followers, by George Y. Ono, Case Institute of Technology, Cleveland, Ohio. 1952 ASME Semi-Annual Meeting paper No. 52—SA-33 (mimeographed).

THE problem of pressure angles in cam followers is an elementary one and yet only approximate methods for the determination have heretofore been presented. In many cases graphical layouts were necessary to find the magnitude and location of the maximum pressure angle. The method presented in this paper permits an accurate means of maximum angle determination for any follower motion for which the velocity and acceleration characteristics, $ds/d\theta$ and $d^2s/d\theta^2$, respectively, can be written. The method is not entirely original to the writer. By using an elementary velocity solution, S. H. Billings derived similar equations for parabolic and simple harmonic motions which, however, did not directly relate the location and magnitude of the maximum pressure angle to lift, cam angle, and base circle diameter.

Comparison of the maximum pressure angles related to the three motions considered shows that in the commonly used range of s_0/D less than one half, the cycloidal motion gives only a slightly larger cam than the parabolic or simple harmonic motion. The smoother acceleration characteristic of the cycloidal



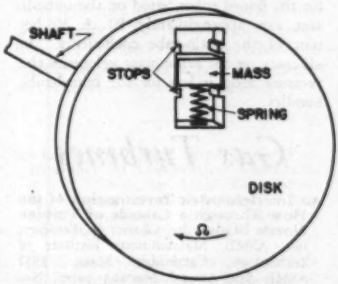
CAM WITH RADIAL FOLLOWER

motion more than offsets this slight disadvantage.

The effect of offsetting the follower to decrease the pressure angles on the rise side of the cam with subsequent increase on the fall side presents a more difficult problem than does the radial roller follower. However, the solution could be derived by methods similar to those presented here.

The Use of the Centrifugal Governor Mechanism as a Torsional Vibration Absorber, by O. A. Pringle, Jun. ASME, University of Missouri, Columbia, Mo. 1952 ASME Semi-Annual Meeting paper No. 52—SA-34 (mimeographed).

IF a body is vibrating, one possible way to reduce or eliminate the vibration is by the addition of a dynamic vibration absorber. For torsional vibration, the most common of these devices are the rotating pendulum absorber and the Frahm absorber. This paper describes



ABSORBER MOUNTED ON A ROTATING DISK

another type of absorber which, although differing in construction from those just mentioned, has quite similar characteristics. The mechanism of this absorber is basically that of a centrifugal governor, consisting of a mass elastically mounted on a rotating body and constrained to move in a radial direction when acted upon by centrifugal force.

Equations for predicting its performance are developed, and comparisons are made with other types of absorbers.

Nomograms as Tools to Facilitate the Solution of Engineering Formulas, by Edward C. Varnum, Barber-Colman Company, Rockford, Ill. 1952 ASME Semi-Annual Meeting paper No. 52—SA-32 (mimeographed).

IN the evaluation of engineering formulas for use in experimental design, product application, and the design of standard machines, nomograms have been found useful. In this paper a brief explanation of straight-line, circular, and curvilinear nomograms is given along with specific examples of each. In addition, reference is made to the Lo-Ho method of constructing nomograms from a table of empirical data and further examples of nomograms constructed by the author are cited.

Compared with a desk calculator, nomograms share with slide rules the advantage of speed and the disadvantage of less accuracy. In those instances, therefore, in which the demand for accuracy is not urgent, such as in checking and estimating, for example, nomograms are timesaving tools so that a study of their availability, use, and, if need be, construction is recommended.

Heat Transfer

Additional Measurements of Heat Conductivity of Nitrogen, Carbon Dioxide, and Mixtures, by F. G. Keyes, Mem. ASME, Massachusetts Institute of Technology, Cambridge, Mass. 1952 ASME Semi-Annual Meeting paper No. 52—SA-10 (in type; to be published in Trans. ASME).

SINCE the Annual Meeting of 1950, measurements of the heat conductivity of three mixtures of nitrogen-carbon dioxide have been continued to higher temperatures and the earlier reported measurements repeated. It is now established for the N_2–CO_2 mixtures at low pressure that the sign of the deviation of the observed heat conductivities computed on the basis of the linear composition proportionality, changes, passing from negative at room temperature to zero at about 150 C, and becoming increasingly positive at higher temperatures. This behavior is unexpected and appears not to have been hitherto observed. The Enskog theory of the conductivity of mixtures does not predict the observed trend nor does the empirical formula of Lindsay and Bromley. The data have been formulated at each of the three constant concentrations of constituents using the same type of equation that has proved useful for the pure components.

A new installation for low-temperature measurements has been completed and tested in the course of calibrating the copper-constantan thermocouples to be used for measuring the temperature gradient and absolute temperature from 30 to —180 C of the fluids whose heat-conductive properties are of interest. The N_2–CO_2 mixtures will be measured along with a series of pure gases and liquids. The measurement of the pressure effect for the heat conductivities of the N_2–CO_2 mixtures has been attempted

but without satisfactory results above 50 C. The difficulty consists of failure of the cell to arrive at a steady state above a comparatively low pressure.

The cause of the phenomenon is believed, as expressed in last year's report, to be directly related to the known tendency of the constituents of a mixture to separate in a temperature gradient.

Local Heat-Transfer Coefficients on the Surface of an Elliptical Cylinder in a High-Speed Air Stream, by R. A. Seban, Mem. ASME, and R. M. Drake, University of California, Berkeley, Calif. 1952 ASME Semi-Annual Meeting paper No. 52—SA-11 (in type; to be published in Trans. ASME).

EXPERIMENTAL investigations of the manner in which the local rate of heat transfer varies over the surface of a heated body immersed in a fluid stream have been conducted for a number of body shapes. Typical results are those presented for circular cylinders, inclined flat plates, and airfoils, all of which were examined in low-velocity air streams. These results are valuable in terms of a direct design objective, for characterizing the flow around the body, and for providing means for checking theoretical methods whereby the distribution of the local heat rate might be predicted.

Further results of this general type are presented in this paper for an elliptical cylinder of 1 to 4 axis ratio which was tested in an air stream. In these tests, air velocities were sufficiently high so that frictional heating was significant, and thus the correct evaluation of the temperature difference to account for the effect of frictional heating is also demonstrated. These present results are given for the major axis of the cylinder parallel to the stream and at a 5-deg angle of attack, the Reynolds-number range being from 607,000 to 1,330,000, with on-stream Mach numbers from 0.20 to 0.53.

Performance of Finned Tubes in Shell-and-Tube Heat Exchangers, by Richard B. Williams and Donald L. Katz, Mem. ASME, University of Michigan, Ann Arbor, Mich. 1952 ASME Semi-Annual Meeting paper No. 52—SA-43 (mimeographed).

HEAT-TRANSFER measurements have been made on three pairs of tube bundles. The bundles of a pair are identical except that plain tubes are used in one bundle and finned tubes in the other. The finned tubes have from 2.07 to 2.76 times as much outside surface as the plain tubes.

Heat-transfer measurements were made for water, lubricating oil, and glycerine on the shell side. Several temperature levels and temperature differences were used to give a variety of viscosities and other fluid properties. Shell-side coefficients were determined by extrapolating to infinite water velocity the over-all coefficients for a series of water velocities inside the tubes. These shell-side coefficients are correlated by the following equation

$$\frac{h_o D}{k} = C \left(\frac{DG_m}{\mu}\right)^{0.60} \left(\frac{C_p \mu}{k}\right)^{0.333} \left(\frac{\mu}{\mu_w}\right)^{0.14}$$

The values of C depend upon the bundle and vary from 0.225 to 0.143. The pressure-drop data are correlated by the methods presented by Donohue.

The heat transferred per degree of temperature difference for the clean finned-tube bundles varied from 110 per cent of that for the corresponding plain-tube bundles for water to 200 per cent for the lubricating oil. For the same mass velocity, the shell-side coefficients for the finned tubes based on the outside area are approximately 80 ± 20 per cent of the plain-tube coefficients. In all cases, at the same mass velocities the pressure drop is less for the finned-tube bundles.

Gas Turbines

An Interferometric Investigation of the Flow Through a Cascade of Turbine Nozzle Blades, by Charles R. Faulders, Jun. ASME, Massachusetts Institute of Technology, Cambridge, Mass. 1952 ASME Semi-Annual Meeting paper No. 52—SA-36 (mimeographed).

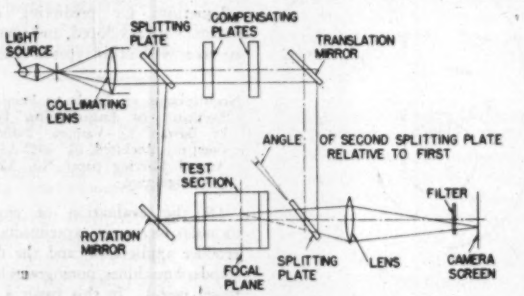
A KNOWLEDGE of the flow within turbine-nozzle cascade passages and immediately downstream therefrom is of interest and importance to the turbine designer. In particular, the measured distribution of pressure around a blade provides an indication of both blade loading and boundary-layer behavior. Characteristics of the flow downstream from the nozzle and of the wake are significant in view of the subsequent influence on rotor bucket performance. These factors were considered in the experiments described in this paper.

The pressure distribution of a turbine nozzle blade, obtained from superimposed flow and no-flow interferometer photographs, was compared with that found from pressure-tap data. Adequate agreement shows the interferometer to be a useful instrument for measuring pressure distributions when the use of pressure taps is prohibited. Photographs taken at a time exposure of two microseconds show an alternating pattern of clearly defined vortexes in the wake. Density contours for the flow downstream from the nozzle, measured interferometrically, illustrate the nonuniformity of the flow in this region and the spread of the wake.

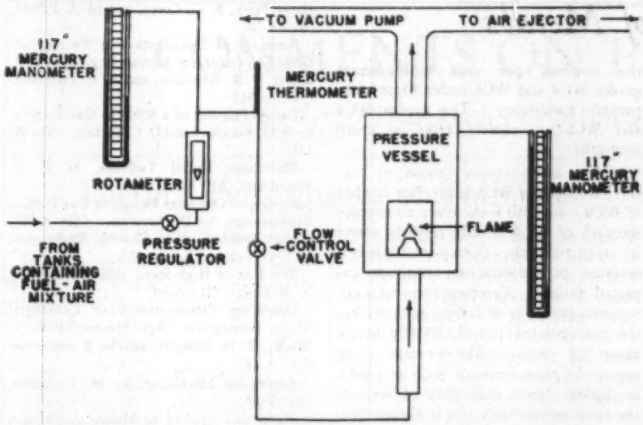
A Nondimensional Correlation of Flame Propagation at Subatmospheric Pressures, by R. E. Cullen, University of Michigan, Ann Arbor, Mich. 1952 ASME Semi-Annual Meeting paper No. 52—SA-39 (mimeographed).

THE rate at which a flame front propagates through an unburned mixture of combustible gases, i.e., a process normally termed a "deflagration," is of fundamental importance to the design and operation of jet-combustion chambers. This paper describes the effect of ambient pressure on the propagation rate of flames in air mixtures of hydrocarbon fuels similar to the fuels employed in present-day jet-combustion chambers. In addition, a correlation of the pressure and scale effects upon flame propagation rates is shown. The importance of this fact to the operation of jet combustors at extreme altitude conditions is discussed.

It is concluded that the normal flame speed for the fuels studied varies inversely with the logarithm of the pressure from atmospheric pressures to as



SCHEMATIC DIAGRAM SHOWING INTERFEROMETER LIGHT PATHS



LINE DIAGRAM OF APPARATUS

low as one inch Hg absolute. A nondimensional parameter, the Peclet number, is established that correlates the results with four burner sizes, two fuels, and for the range of pressures investigated. It is concluded that the Peclet number must be kept large to avoid considerable reductions in flame speeds at subatmospheric pressures.

Design Factors in the Development of a Small High-Heat-Release Combustor, by C. S. Stone, AiResearch Manufacturing Company, Los Angeles, Calif. 1952 ASME Semi-Annual Meeting paper No. 52—SA-52 (mimeographed).

THIS paper offers a discussion of some of the variables affecting the design of can-type combustors for small gas turbines. In addition to a description of the development procedure and test facilities, if offers brief discussion on those factors affecting pressure loss, combustion efficiency, carbon formation, ignition range, and flame-tube material.

In general, it may be said that the basic problems associated with pressure loss are the same as those of the larger combustor used in main propulsion engines. It can be expected that the smaller combustor will be capable of increased load-carrying capacity with equal combustion efficiencies. It is also anticipated that the increased turbulence available in the smaller combustor will more than make up for the relatively short lengths available for combustion and mixing. Carbon formation will be a more difficult problem with the smaller combustor; however, the decrease in the surface area for carbon to form will tend to minimize this source of difficulty. The metallurgical problems are severe. However, they are apparently no more severe than those encountered in the larger combustors.

An Energy Basis for Comparison of Performance of Combustion Chambers, by J. B. Nichols, Jun. ASME, General Electric Company, Schenectady, N. Y. 1952 ASME Semi-Annual Meeting paper No. 52—SA-37 (mimeographed).

THE quality of a combustion chamber is usually defined by the combustion efficiency or the energy represented by air temperature rise compared to the heating value of the fuel used.

The energy loss in a combustion chamber, due to pressure drop, is generally found to be of relatively greater importance than the losses due to combustion inefficiency. It must, therefore, be included in any parameter which claims to state the efficiency of the burner.

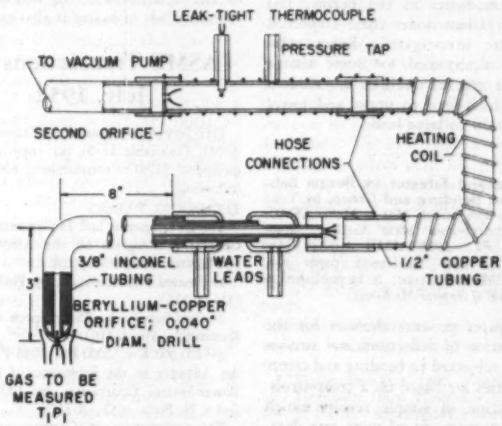
Combustion efficiency alone does not serve this purpose. A method of comparison is suggested and developed which allows combustion chambers to be compared on an over-all energy basis. By this method, any combustion chamber is assigned a single energy efficiency which includes the effects of both combustion efficiency and pressure drop.

Sonic-Flow-Orifice Temperature Probe in High-Gas-Temperature Measurement, by Perry L. Blackshear, Jr., Lewis Flight Propulsion Laboratory, National Advisory Committee for Aeronautics, Cleveland, Ohio. 1952 ASME Semi-Annual Meeting paper No. 52—SA-38 (mimeographed).

A BRIEF discussion of the problem of measuring temperatures in jet engines is given.

A method of measuring these temperatures by pneumatic means is described. This involves the use of two sonic flow orifices in series to give, through thermodynamic calculations, the total temperature of the gas entering the first orifice.

An evaluation of this method is given including a discussion of the sampling error in nonhomogeneous gases, and an experimental comparison against a thermocouple and the sodium D line reversal method is made showing favorable agreement. Results of applying this method of measuring temperature in full-scale engines are discussed.



SCHEMATIC DIAGRAM OF SONIC-FLOW TEMPERATURE PROBE

Properties of Metals

Comparisons at Elevated Temperatures of Some Commercial Grades of Ferritic Cast Steels, by H. W. Wyatt, Jun. ASME, J. W. Bolton, and M. L. Steinbuch, The Lunkenheimer Company, Cincinnati, Ohio. 1952 ASME Semi-Annual Meeting paper No. 52—SA-53 (mimeographed).

THIS paper presents some direct elevated-temperature test comparisons of cast steel Grades WC4, WC5, WC6, and WC9 of ASTM Specification A217-49T. The materials studied are from commercial heats. Care has been taken to hold all variables in manufacture, treatment, and composition (aside from prescribed "alloy elements") as closely alike as possible. The tests show that:

1 Creep-strength characteristics of Grades WC5 and WC9 (within temperature ranges studied) are similar. Both these one per cent molybdenum grades are superior in creep strength to the one-half per cent molybdenum grades WC4 and WC6 under these comparable conditions. The grades WC4 and WC6 are closely alike in creep strengths.

2 The creep-rupture (stress to rupture) strength of WC5 is superior to that of WC9. At 1050 F the creep to rupture strength of WC9 is only slightly above its creep strength. (Creep strength is a measure of deformation, without expected failure. Creep-rupture strength suggests breakage or failure at or within the extrapolated period, 100,000 hr, or about 11 years.) The average creep rupture of three heats of WC6 at 1050 F is slightly lower than that of WC9 at the same temperature but is higher than the creep strength of WC6.

3 Graphitization is not an expectancy in any of the four grades studied.

Applied Mechanics

The Limit Design of a Transversely Loaded Square Grid, by Jacques Heyman, Brown University, Providence, R. I. 1952 ASME Applied Mechanics Division Conference paper No. 52—APM-2 (in type; to be published in the *Journal of Applied Mechanics*).

AN earlier paper discussed the derivation of a breakdown criterion for beams subjected to combined bending and torsion. The present paper deals with the limit design of grids, formed by two sets of parallel beams intersecting at right angles, subjected to transverse loading at the joints. This form of loading introduces both bending and twisting moments in the beams, and modes of failure under these combined actions are investigated. Exact solutions are determined for some simple grids, but general methods are demonstrated which lead to upper and lower bounds on the collapse load.

Deflection and Stresses in Beams Subjected to Bending and Creep, by Yoh-Han Pao and Joseph Marin, Mem. ASME, The Pennsylvania State College, State College, Pa. 1952 ASME Applied Mechanics Division Conference paper No. 52—APM-34 (in type; to be published in the *Journal of Applied Mechanics*).

THIS paper presents theories for the determination of deflections and stresses in beams subjected to bending and creep. The theories are based on a creep-stress-time relation in simple tension which gives an accurate fit of most test data. The theory takes into account the variation in stress distribution in bending with time. For this purpose a time-hardening theory is used to express the stress variation or stress relaxation of each fiber in bending. A comparison between actual creep deflections for Plexiglas specimens subjected to pure bending and values predicted by the proposed theory shows good agreement between experimental and theoretical results. The creep behavior for other materials in tension indicates that this method could be used for predicting bending creep deflections for these materials. The application of the theory to the determination of deflections in various kinds of beams is also explained.

ASME Transactions for July, 1952

THE July, 1952, issue of the Transactions of ASME (available at $1 per copy to ASME members; $1.50 to nonmembers) contains the following:

TECHNICAL PAPERS

The Development and Implementation of a Generation Program on the American Gas and Electric Company System:

1—System Fundamentals, by Philip Sporn. (51—A-115)

2—Fuel Supply, by Philip Sporn and H. A. Kammer. (51—A-116)

3—200,000 Kw, 2000 Psi, 1050 F/1050 F—An Advance in the Economics of Integrated Power-System Generation, by Philip Sporn and S. N. Fiala. (51—A-117)

Thermodynamics of Gasification of Coal With Oxygen and Steam, by W. C. Edmister, Harry Perry, R. C. Corey, and M. A. Elliott. (51—A-20)

Summary of Investigation of Two-Stroke-Cycle Gas-Generator Aircraft Engine, by B. I. Sather, F. R. Schuricht, and A. E. Biermann. (51—A-131)

Design Features of a 5000-Hp Gas Turbine, by B. O. Buckland and D. C. Berkey. (51—A-113)

Multistage Radial Turbines, by P. F. Martinuzzi, (51—F-15)

Review of Optimum Design of Gas-Turbine Regenerators, by D. Aronson. (51—A-107)

High-Speed Cascade Testing Techniques, by F. H. Keast. (51—SA-31)

The Life of High-Speed Ball Bearings, by A. B. Jones. (51—A-69)

Operating Characteristics of Cylindrical Roller Bearings at High Speeds, by E. F. Macks, Z. N. Nemeth, and W. J. Anderson. (51—A-66)

Angles for Machining, by M. F. Spotts. (51—F-19)

Hydraulics Applied to Molten Aluminum, by D. S. Richins and W. O. Wetmore.

Measurement of Hydraulic-Turbine Vibration, by John Parmakian and R. S. Jacobson. (51—A-88)

Design of Flat-Wound Tension Springs, by R. M. Conklin and D. R. Forry. (51—A 59)

Hysteresis of Shaft Materials in Torsion, by W. P. Welch and B. Cametti. (51—A-64)

A Time-Temperature Relationship for Rupture and Creep Stresses, by F. R. Larson and James Miller. (51—A-36)

Effect of Temperature Variation on the Long-Time Rupture Strength of Steels, by E. L. Robinson. (51—A-33)

High-Temperature Stress-Rupture Testing of Tubular Specimens, by L. F. Kooistra, R. U. Blaser, and J. T. Tucker, Jr. (51—A-44)

Rupture and Creep Characteristics of Titanium-Stabilized Stainless Steel at 1100 to 1300 F, by J. W. Freeman, G. F. Comstock, and A. E. White. (51—A-46)

Experimental Superheater for Steam at 2000 Psi and 1250 F—Progress Report of Field Operation, by F. G. Ely and F. Eberle. (51—A-37)

Behavior of Superheater Tubing Materials in Contact With Combustion Atmospheres at 1350 F, by H. A. Blank, A. M. Hall, and J. H. Jackson. (51—A-42)

Determination of Principal Plastic Strains, by W. E. Cooper. (51—A-128)

Discharge Measurements by Means of Cylindrical Nozzles, by A. L. Jorissen and H. T. Newton. (51—A-63)

Linear-Resistance Meters for Liquid Flow, by R. C. Souers and R. C. Binder. (51—A-57)

Oil Flow in Plain Journal Bearings, by S. A. McKee. (51—A-34)

Oil Flow, Key Factor in Sleeve-Bearing Performance, by D. F. Wilcock and Murray Rosenblatt. (51—A-89)

On the Solution of the Reynolds Equation for Slider-Bearing Lubrication—I, by A. Charnes and E. Saibel. (51—A-43)

Effect of Variations in Viscosity of Lubricants Upon Timken OK and Psi Values, by I. S. Kolarik, C. A. Zeiler, and E. M. Kipp. (51—A-35)

Wet Compression in an Axial-Flow Compressor, by Shao-Lee Soo. (51—A-99)

COMMENTS ON PAPERS

Including Letters From Readers on Miscellaneous Subjects

Thermal Performance of Turbines

COMMENT BY J. E. DOWNS[1]

In this paper[2] the authors present heat-rate data and information to permit the calculation of throttle, reheat extraction, and condenser flows. This data will prove useful and interesting to the users of large steam-turbine generators.

For reheat turbines, the authors of this paper base their heat added data on a reheat pressure equal to 25 per cent of the initial pressure. This represents reheat pressures at capability of 316 psia for the 1250 psig turbine, 366 psia of the 1450-psig turbine, 454 psia for the 1800-psig turbine, and 604 psia for the 2400-psig turbine. These reheat pressures for the 1250 and 1450-psig turbines are considerably lower than requested by users of turbines built by the writer's company. Likewise, the 604-psia reheat pressure for the 2400-psig alternate is considerably higher than used on the applications of this initial pressure with which the writer is familiar. The final feedwater temperatures in Table 3 are 17 to 23 deg F higher than would be obtained with the top feedwater heater extracting steam from the cold reheat line, and with the reheat pressures as shown. The writer is familiar with no application where the final feedwater temperature is different by this amount from that obtained from a heater at the reheat point. Some clarification of this would be appreciated.

The power required by the boiler feed pump and rise in liquid enthalpy due to compression has not been taken into account in the heat rates given. The combined net effect of these two items increases the heat rate approximately 1 per cent per 1000 lb initial pressure on nonreheat turbines, and approximately 0.8 per cent per 1000 lb initial pressure on reheat turbines. This factor, of course, must be considered by the user when alternate steam conditions and reheat versus nonreheat are being studied at the higher initial pressures.

The authors use the same per cent of the throttle flow extracted for feedwater heating for both reheat and nonreheat turbines for a given total rise in feedwater temperature. A refinement of the flow calculations can be easily accomplished by multiplying the per cent extraction flow by a factor of 0.93 to correct for the higher average enthalpy of the steam extracted from reheat turbines.

COMMENT BY B. C. MALLORY[3] AND W. F. ALLEN, JR.[4]

Published data on turbines manufactured by the author's company cover units up to 60 mw size only, with the exception of the 100-mw preferred standard units. Extension of this type of information over the range of 75 mw to 200 mw serves a useful purpose as it facilitates setting up economic studies for selection of unit size, initial steam conditions, exhaust conditions, and number of stages of feed heating for new generating stations.

Heat rates, directly from the paper or after correction for the rise in liquid enthalpy due to compression and pump power between condenser and steam generator,[5] may be used to determine and compare fuel costs for various unit sizes, initial steam conditions, exhaust conditions, and number of heaters. Many times it is essential that the corrected heat rates be employed in order to obtain an accurate and realistic comparison of fuel costs. Throttle flows and reheater flows which are obtained from heat rates and reheater-flow factors may be used to obtain estimated prices for steam generators and allied equipment. The total extraction flow curve in conjunction with the throttle-flow information may be used to determine condenser flows, which in turn may be used for estimating condenser and pump prices.

The flow data are presented in a convenient and readily usable form. Without detracting from the excellence of these data for many purposes, it may be of some assistance to others to mention that in order to accomplish this convenient tabulation, the authors have made assumptions which are not strictly compatible for all cases, and the probable accuracy of the flow values is not as great as might be implied from the examples. The same percentage of extraction is given for reheat and nonreheat units for the same number of stages of feed heating and final feedwater temperature, whereas the percentage extraction for reheat and nonreheat units may differ by several per cent. Using as an example the 100-mw preferred standard units at 100-mw load, 1.5 in. Hg abs exhaust pressure with five heaters and 442 F feedwater temperature, published data[6] give the ratio of total extraction flow and throttle flow as 0.286 for the reheat unit and 0.306 for the nonreheat unit.

The authors note that variations in the feed heating cycle, such as the use of drain coolers, desuperheating sections, and varying terminal difference, rarely affect the heat rate by more than 1 per cent. In some cases a capital expenditure of $200,000 may be justified for a decrease of 1 per cent in heat rate on a 100-mw unit. It behooves the power-plant designer to consider carefully the effect of varying terminal difference and the use of drain coolers and desuperheating sections on heat rate.

From Fig. 15 of the paper, at optimum final temperature, increasing the terminal difference from 0 to 8 deg F causes an increase in heat rate of 1.001 times the heat rate. The heat rate for the 60-mw preferred standard unit, 850 psig, 900 F, with 400 F final feed temperature and five heaters, is 9305 Btu per kwhr at rated load. Using the factor from the curve results in a value of 9.3 Btu per kwhr for 8 F terminal difference or 1.2 Btu per kwhr per degree of terminal difference.

Recent calculations by a difference method, which is believed to be reasona-

[1] Large Steam Turbine and Generator Department, General Electric Company, Schenectady, N. Y. Mem. ASME.

[2] "Thermal Performance of Modern Turbines," by H. R. Reese and J. R. Carlson, MECHANICAL ENGINEERING, vol. 74, March, 1952, pp. 205–211.

[3] Chief Mechanical Engineer, Stone & Webster Engineering Corporation, Boston, Mass.

[4] Mechanical Division Engineer, Stone & Webster Engineering Corporation.

[5] "Steam Turbines and Their Cycle," by J. K. Salisbury, John Wiley & Sons, Inc., New York, N. Y., 1950, pp. 519–524.

[6] "Performance Data 1260. Condenser Turbine Generator Units 12,650-Kw to 100,000-Kw, Inclusive," AIEE-ASME Preferred Standard Rating. Westinghouse Electric Corporation, Pittsburgh, Pa., June, 1951.

bly accurate,[7] indicates that this value is 1.6$ Btu per kwhr. Similar calculations on a number of units up to 125 mw in size indicate in all cases values over $1^1/_2$ Btu per deg of top heater-terminal difference for fixed-turbine designs. It would be informative if the authors would explain on what basis the terminal-difference correction curves were calculated, and specifically if the curves are intended to apply to fixed-turbine designs and the consequent variable final fuel water temperature.

AUTHORS' CLOSURE

The comments by Mr. Downs are constructive and appreciated. They also afford an opportunity to clarify some points which may not be clear.

Reheating at 25 per cent of the initial pressure results in about optimum efficiency. As pointed out by Mr. Downs, it is on the low side for the lower initial throttle pressure and on the high side for the high initial throttle pressure. In general, the variation in heat rate for variations in reheat pressure are quite small, and do not detract from the purpose of this paper. In actual practice, the final feedwater temperature, when the steam is taken from the colder reheat steam line, would be approximately 440, 450, and 460 F, respectively, for the initial throttle pressures of 1450, 1800, 2400 psig.

Boiler feed-pump power, rise in liquid enthalpy due to compression, absorption of heat in the air-ejector condenser, hydrogen coolers, and oil coolers are not included in the heat-rate calculations. These items were purposely omitted so as to make this data line up as closely as possible with the heat rate data published on the "AIEE-ASME Preferred Standards" turbine generator units.

Mr. Downs' comment of the use of the same percentage of throttle flow extracted for feedwater heating for both reheat and nonreheat turbines is correct and was recognized by the authors, but the original preprints inadvertently omitted this correction factor which we find also to be 0.93 for reheat units. Later reprints include this factor.

We appreciate the comments of Messrs. Mallory and Allen, as they served to emphasize the primary purpose of this paper, namely, that of providing heat-rate data and a means of determining accurately differences in heat rates for varying steam conditions and kw ratings. The actual heat-rate guarantees obtained on specific orders may vary either up or down without effecting the usefulness of this data.

It is recognized that variations in the heat-balance arrangement will have an effect on the heat rates. It is because of this fact that the basis of all heat-rate calculations have very carefully been defined. Reduced terminal difference, the use of drain coolers, and desuperheating sections will, of course, improve the heat rates, but their effect need not be taken into account until the ultimate selection of kw rating and initial steam conditions has been made.

Fig. 15 gives the effect on heat rate, for a change in terminal differences only on the top heater. It is based on a constant final feed temperature.

The method referred to by Messrs. Mallory and Allen also includes an effect of change in the feed temperature which accounts for the discrepancy in their results. The change in heat rate due to a change in final feed temperature can be obtained from Figs. 9 and 10 or the steam power-plant planning guide.

We appreciate the written comments on this paper as we believe it indicates an interest in the desirability of the preparation and publication of turbine heat-rate data.

H. R. REESE.[8]

J. R. CARLSON,[8] Mem. ASME.

[8] Steam Division, Westinghouse Electric Corporation, South Philadelphia Works, Philadelphia, Pa.

[7] "Evaluation of the Effect of Terminal Difference and Pressure Drop on Steam Power Plant Heat Rate," by W. F. Allen, Jr., Paper No. 51—F-28, presented at the Fall Meeting, Minneapolis, Minn., September 25–28, 1951, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

REVIEWS OF BOOKS

And Notes on Books Received in the Engineering Societies Library

Work Measurement

WORK MEASUREMENT: New Principles and Procedures. By Adam Abruzzi. Columbia University Press, New York, N. Y., 1952. Cloth, $5^3/_4 \times 9$ in., 55 tables, 25 figs., bibliography, index, xviii and 290 pp., $6.

REVIEWED BY PHIL CARROLL[1]

HERE is a book describing a series of research projects. They were set up to test statistically the correctness of most of our current time and motion-study practices. Most of the work studies were made under actual manufacturing conditions in two plants. Those observed were members of the International Ladies Garment Workers Union.

Chapter 1 outlines the problem to be studied. Chapter 2 designs the research program and sets down two premises that seem to bear on the author's conclusions. One is that operators bargain informally by regulating their performances to "their individual abilities and needs." This and two other bargaining stages, according to Dr. Abruzzi, "demonstrate conclusively that time study is not an independent scientific process in practice." The other premise is that performance rating has "no place in a set of objective procedures for estimating and evaluating production rates."

Chapter 3 takes up the problems of process standardization. Here the author states another condition that appears to influence his results. He says that "the recommended criteria of preliminary standardization are uniformly subjective and descriptive." Later in concluding chapter 12, he makes the point that the one best way "can only be conceived formally as a convenient abstraction describing an ideal situation."

As I interpret the foregoing, Dr. Abruzzi carefully avoids the judgments of both pace-rating and method standardization. With these conditions, chapters 4, 5, 6, and 7 are given to statistical analyses of actual time-study observations. Chapter 8 cites the pros and cons of standard data for operation elements and motions. Chapters 9, 10, and 11 are given to statistical demonsrrations that operators use different methods. Among his conclusions, he states that "element-standard data is apparently an impos-

[1] Consulting Industrial Engineer, Maplewood, N. J. Fellow ASME.

sibility for all operations" where the employee can appreciably influence the work method and the work pace.

Chapters 12 and 13 examine motion-standard data by means of motion pictures taken of a bolt, washer, and nut assembly. The conclusion is that the "likelihood of developing motion-standard data is apparently even more remote than the likelihood of developing element-standard data."

Chapter 13 compares the accuracies of snapback and continuous watch readings. Also compared are stop-watch and marstochron readings with the wink-counter readings photographed in films.

Chapter 14 studies the setting of rest and delay factors by statistical means.

This research study seems to prove that people work at different paces and by different methods. If, as the author suggests, some of these differences are introduced as "informal bargaining," perhaps the scientific approach will have to be by the "theory of games" method developed by von Neumann. Apparently, too, operators introduce "delays" at different points in their work cycles. This appears to verify the belief of some practitioners that people take the major part of what we call "fatigue allowance" all through the work-day.

However, because of these differences and delays in work patterns, the author concludes that motions and elements need to be grouped, in the main, before their comparisons are statistically valid. You may conclude from the discussion, that element or motion data should be built up for each individual.

Chapter 11 seems to say that an operation must be in work before it can be checked. If this is a correct interpretation, then Dr. Abruzzi would disagree with the measurement of short runs and nonrepetitive work like setups, maintenance, and much other indirect.

Those who understand statistical analysis will want to read this book. Those who practice in the field will be interested to learn why most of their methods are not statistically acceptable.

Flames and Furnaces

THE SCIENCE OF FLAMES AND FURNACES. By M. W. Thring. John Wiley and Sons, Inc., New York, N. Y., 1952. Cloth, $5^1/_4 \times 8^1/_2$ in., figs., tables, index, xiv and 416 pp., $6.50.

REVIEWED BY W. TRINKS[2]

THE author, who is a well-known British physicist, has endeavored to improve the art of design and operation of industrial furnaces by injecting more science into the art. The definition that science is co-ordinated knowledge applies to Mr. Thring's book; it contains 368 references to experimenters and authors.

The first chapter describes and gives 29 illustrations of furnaces for these industries: Iron and steel, nonferrous metals, chemical, and clay and building materials.

The second chapter bears the title: The Thermodynamics of Furnace Heating. It deals with the potential (chemical) and the sensible energies of fuel, with fuel efficiencies, with diagrams of heat-flow, and in great detail with quality and "virtue" of energy. The last two terms are functions of the adiabatic flame temperature and are closely related to Bansen's "Wärmewertigkeit." Heating in parallel flow and in counterflow is discussed. Unfortunately, the scientifically more difficult problem of heating in cross-flow is not discussed. A diagram for calculation of oxidation and of reduction is offered, and the use of oxygen in furnaces is discussed.

The third chapter is called The Liberation of Heat by Combustion. It deals with reactions between gases (including the combustion reaction) and shows how to obtain either rapid combustion or delayed combustion. The use of gas-sampling tubes is explained. Detailed information is given on the reactions in beds of solid fuel and on the combustion of pulverized coal. The combustion of oil is discussed in a rather sketchy manner, probably because oil firing is not as common in England as it is in the United States.

The fourth chapter deals with the transfer of heat from flame to charge, to and through walls and their openings, and in heat exchangers (recuperators and regenerators). Unsteady heat flow as caused, for instance, by intermittent heating, is also discussed.

The fifth chapter bears the title Aerodynamics of Hot Systems. (*Gasodynamics* would have been more appropriate.) In this chapter the flow of furnace gases, caused by buoyancy, fans, and jets, and opposed by frictional resistances, is studied. The contribution to theory of injectors (inspirators) is appreciated. Six pages are given to measuring flow of furnace gases experimentally. This chapter is very complete.

The sixth chapter is called The Science of Furnace Construction. It contains information on strength and durability of hearths, roofs, and side walls.

The title of the seventh chapter is The Application of the Scientific Method to Furnaces. This chapter teaches how to use the knowledge of the earlier chapters for the purpose of improving quality of product and fuel efficiency by several methods, such as spot measurements, instrumentation, and statistics. The latter method consists in comparing the performance of existing furnaces of a given type and studying the effect of variation of dimensions, location of burners, rate of firing, and the like. In this chapter formulas are developed by means of which the performance of furnaces is related to important variables.

The study of Thring's book will be enjoyed principally by technical physicists and by research engineers. Such men are used to degrees Centigrade and to Centigrade heat units, which are standard in the book. However, the author often uses Btu, degrees Fahrenheit therms, and kilogram calories. He also uses British tons and metric tons, and so on. Since the book is intended principally for inhabitants of Great Britain, costs are expressed in pounds and shillings. When speaking of "this country," the author means England.

The book under review is limited to the effects of flames in furnaces; it does not cover the whole science of industrial furnaces. Nothing is said about protective atmospheres, safety against explosions, labor-saving devices, and still other subjects. In Great Britain, fuel economy is very important, whereas most furnaces are, in the United States, sold on labor economy.

Having written 12 books (inclusive of new editions), the reviewer fully realizes that it is almost impossible to make a first edition perfect. Mr. Thring is to be congratulated upon his work, but the book contains many misprints and a number of wrong statements. There are also some errors in the illustrations. While anyone skilled in the art will readily recognize the errors, a novice may be led astray. In future editions, the shortcomings of the first edition will doubtless be eliminated.

[2] Partner, Associated Engineers, Pittsburgh, Pa. Fellow ASME.

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Powder Metallurgy

TREATISE ON POWDER METALLURGY. Vol. 3, Classified and Annotated Bibliography. By C. G. Goetzel. Interscience Publisher, Inc., New York, N. Y.; Interscience Publisher Ltd., London, England, 1952. Cloth, 5¾ × 9 in., patent cross-index subject and name indexes, xxiv and 899 pp., $22.

REVIEWED BY A. J. LANGHAMMER[1]

POWDER metallurgy as of today is a broad subject. The reason is manifold. Included are the facts that end products are made from ferrous and nonferrous metals, also alloys, and/or mixtures; the end use may vary from a cutting tool, machine part, filter, bearing material, electronic part, or highly specialized units. Thus it becomes of increasing importance to men of industry, including top management, engineers, production executives, and others, to have available a classified bibliography on this subject.

In that regard Claus G. Goetzel's "Treatise on Powder Metallurgy," volume 3, is genuinely outstanding. In addition to powdered-metal products it deals also with the raw materials, manufacturing equipment, machinery and processes for both the raw materials and finished products, and a quite complete patent survey. Reference citations alone number twelve thousand, in round numbers, which gives a picture of the formidable amount of data collected.

All citations are clearly and accurately presented, and are accompanied by terse but highly informative descriptions. It should be emphasized that the over-all information is quite complete. It includes reference to theoretical data, textbooks, and items of both scientific and practical nature.

There are many theories pertaining to sintering and other details of powder metallurgy and numerous other factors are not identified; therefore they are not labeled or controlled. Specifically, there are particle characteristics and behavior and particle shape. The author lists the work that has been done with regard to these specific items, and many others.

Claus G. Goetzel's Treatise on Powder Metallurgy, Volume 3, annotated bibliography, is an excellent book, complete—actually world-wide, presented in a clean-cut, interesting manner, and is a book that anyone interested in the subject will find a valuable addition to his library. It will likewise be found of general interest, and particularly useful for universities, libraries, engineering departments, and of special value to those engaged in research and development.

[1] President, Amplex Division, Chrysler Corporation, Detroit, Mich. Mem. ASME.

Books Received in Library

ASTM SPECIFICATIONS FOR STEEL PIPING MATERIALS. Prepared by ASTM Committee A-1 on steel. American Society for Testing Material, Philadelphia, Pa., 1952. Paper, 6 × 9 in., 372 pp., tables, charts, diagrams, paper, $3.50. This compilation contains all ASTM specifications for carbon-steel and alloy-steel pipe and tubing. It covers pipe to convey liquids, vapors, and gases at normal and elevated temperatures, still tubes for refinery service, and tubes for boilers, heat exchangers, condensers, and superheaters. Specifications are also included for castings, forgings, bolts, and nuts used in piping installations. A number of emergency alternate provisions in separate form are provided with the book or will be sent subsequently.

AIRCRAFT FABRICATION. Mock-up; lofting and layout; reproduction of lines, parts 1 and 2—basic problems and heat-treatment; templets; aircraft riveting; cast and molded dies; steel dies; drop hammers and press brakes; hydraulic and stretch presses; bending, drawing, rolling, and spinning; forming by hydraulic and crank presses; blanking; spot welding of aluminum alloys; airframe assembly tools. International Textbook Company, Scranton, Pennsylvania, 1943. Paper, 5 × 7½ in., approximately 50 pp. each, illus., diagrams, tables, charts. Prices vary from $1.00 to $1.65. The basic processes in the manufacture of aluminum airframes are dealt with in separate pamphlets. Topics covered include mock-up, lofting and layout, templets, heat-treatment of aluminum, forming and cutting equipment, diets, riveting and welding, and airframe-assembly tools. The practical value of the text is increased by the extensive use of illustrative diagrams, drawings, and photographs.

ANALYTICAL MECHANICS FOR ENGINEERS. By Fred B. Seely and Newton E. Ensign. John Wiley and Sons, Inc., New York, N. Y., fourth edition, 1952. Bound, 5½ × 8¾ in., 443 pp., diagrams, graphs, $5.50. The principles of mechanics that are essential for engineers are presented in four sections: statics; kinematics; kinetics; and the special topics of vibrations and balancing. The intention is to develop these principles from common experience, to apply them to practical problems, and to emphasize their physical interpretations. New illustrative problems have been added, and the material has been revised in accordance with current ideas to provide a more logical presentation.

BASIC ENGINEERING THERMODYNAMICS. By Vincent W. Young. McGraw-Hill Book Company, Inc., New York, N. Y., first edition, 1952. Bound, 6¼ × 9¼ in., 358 pp., tables, charts, diagrams, graphs, $6.50. Designed to give full coverage of the subject of thermodynamics for undergraduate students in mechanical engineering, this book lays the groundwork for all normally important topics including heat transfer and those applications to chemistry which are of interest to the engineer. The basic theoretical treatment is tied to practice by the discussion of the differences between real and ideal operation and by numerous practical examples.

BIBLIOGRAPHICAL SURVEY OF FLOW THROUGH ORIFICES AND PARALLEL-THROATED NOZZLES. (B.S.I.R.A. Research Publication, M. 9.) By T. H. Redding. Chapman & Hall Ltd., London, England, 1952. Bound, 6¼ × 10 in., 196 pp., diagrams, 32s 6d. More than 600 entries classified under sixteen subject headings comprise this bibliography, which covers the period 1832 to 1946. The references are arranged in chronological order under each heading, are annotated for more effective use, and cross references are supplied to allied material under other headings. There are also an explanatory technical introduction, an author index to the bibliography, and a glossary of terms used in flowmetering practice

BIBLIOGRAPHY: TRUING OF GRINDING WHEELS. From 1910 to June, 1951. Industrial Diamond Information Bureau, London, England. Third revised edition, 1952, paper, 7½ × 9¾ in., 39 pp. Some 900 articles are listed in this compilation, arranged chronologically, and with brief notes indicating the scope of the article if the title is not sufficiently descriptive. An author index is provided. Similar publications are available listing diamond-tool patents, industrial-diamond applications, and so on.

DAMPFERZEUGUNG, DAMPFKESSEL, FEUERUNGEN. Theorie, Konstruktion, Betrieb. By Maximilian Ledinegg. Springer-Verlag, Vienna, Austria, 1952. Bound, 8 × 11 in., 427 pp., diagrams, tables, charts, illus., $18.80. This comprehensive text on steam generation covers theory, equipment design, and operating principles. The extensive use of graphs and diagrams both aids in understanding the underlying theory and facilitates design procedures. Detailed information is provided for the engineer or advanced student, although the general treatment is suitable for introductory purposes.

ENGINEERS AND IVORY TOWERS. Edited and arranged by Robert C. Goodpasture from published and unpublished papers of Hardy Cross. McGraw-Hill Book Company, Inc., New York, N. Y., 1952. Bound, 5¾ × 8¼ in., 141 pp., $3.50. A selection and compilation, in essay form, of the nontechnical writings and lectures of an eminent teacher and structural engineer. The content of the book reflects the author's opinions on the relationship of engineer and engineering to science and the humanities, touching on a wide range of subjects including education, graduate study, standardization, and the responsibilities and obligations of engineers.

EXHAUST HOODS. By J. M. Dalla Valle. Industrial Press, New York, N. Y., second edition, 1952. Bound, 6¼ × 9¼ in., 146 pp., tables, diagrams, charts, illus., $3.50. Comprehensive information is given on the flow of air around and into the openings, hoods, or slots in exhaust ventilating systems. Full instructions are given for the design of hoods for removing dust, fumes, and gases under various conditions such as in grinding, woodworking, electroplating, and so on. Calculations are given for five actual designs.

INDUSTRIAL HEAT TRANSFER. By F. W. Hutchinson. The Industrial Press, New York, N. Y., 1952. Bound, 6¼ × 9¼ in., 326 pp., tables, charts, $6. A combined text and reference book, providing a selective approach to problems of heat-transfer analysis and to the rapid evaluation of coefficients and rates. In addition to the basic relationships for conduction, radiation, convection, and combined heat transfer for which both equations and graphs are given, there are individual graphs for forced convection of some 70 gases and liquids, alphabetically arranged. The graphs are scaled for accuracy comparable to the equations, and explanatory text material appears on the facing pages.

INDUSTRIAL PROCESS CONTROL BY STATISTICAL METHODS. (Industrial Organization and Management Series.) By John D. Heide. McGraw-Hill Book Company, Inc., New York, N. Y., 1952. Bound, $6^1/_4 \times 9^1/_4$ in., 297 pp., tables, charts, $6. Providing both an introduction to the statistical methods required and an explanation of the practical and technical problems involved in their application, this book is useful as a text for the student or as a manual for the plant manager. It covers process frequency distributions, control charts, and limit lines; discusses the study of process data, factory installation, and practical program aids; and deals, in general, with organization, administration, and the evaluation of test procedures and results.

MECHANICS OF FLUIDS. By Glenn Murphy, International Textbook Company, Scranton, Pa., second edition, 1952. Bound, $6^1/_4 \times 9^1/_2$ in., 309 pp., tables, diagrams, graphs, $6. In this introductory textbook on the behavior of fluids the approach and techniques are those which have proved successful in the mechanics of solids. The basic method of analysis is that of the free-body, used in conjunction with the fundamental principles of mechanics, expressed in Newton's laws of motion. Numerous practical applications of the theory are cited, and numerical and laboratory problems are provided. Important revisions are in the material on viscosity, flownets, jets, fluid couplings, and automatic transmissions.

MANUAL OF ASTM STANDARDS ON REFRACTORY MATERIALS. Prepared by ASTM Committee C-8 on Refractories. American Society for Testing Materials, Philadelphia, Pa., 1952. Cloth and paper, 6×9 in., 294 pp., tables, diagrams, illus., $3. (Cloth, $3.65.) In addition to the latest approved forms of 37 standard and tentative specifications the current edition of this manual includes other pertinent information of value in the testing and use of refractories. There are suggested procedures in petrographic techniques and for calculating heat losses through furnace walls, standard samples for chemical analysis, industrial surveys of service conditions of refractories, a proposed glossary, and so on.

METHODS OF ANALYSIS OF FUELS AND OILS. By J. R. Campbell. Chemical Publishing Company, Inc., New York, N. Y., 1952. Bound, $5^3/_4 \times 8^3/_4$ in., 216 pp., tables, diagrams, graphs, $4. A laboratory guide to the principal methods of examination of gaseous, liquid, and solid fuels and lubricating oils. Approximately half the book is devoted to coal analyses and tests. The final chapter provides a survey of the methods and equipment for high-temperature measurement. Brief treatments of theoretical principles have been included where it seemed advisable.

NEW APPROACH TO ENGINEERING TOLERANCES. By J. Gilson. The Machinery Publishing Company, Ltd., London, England, 1951. Bound, $5^1/_2 \times 8^1/_4$ in., 99 pp., charts, diagrams, tables, 10s 6d. A critical presentation of the considerations necessary for the establishing and maintenance of realistic achievable tolerances in modern economic production. After a general discussion the author deals with the effect of tolerances on fits and assemblies, with standard limit and fit systems, and the implementation of recommendations. The method of expressing tolerances on drawings is also covered.

NOMOGRAPHY AND EMPIRICAL EQUATIONS. By Lee H. Johnson. John Wiley and Sons, Inc., New York, N. Y., 1952. Bound, $6 \times 9^1/_4$ in., 150 pp., charts, tables, $3.75. Two useful techniques are provided for handling experimental and operational data in business, industry, professional practice, and research. In the first part the characteristics and construction of nomographs are explained with examples of applications of various types. The section on empirical equations explains the methods of fitting curves to plotted data and establishing the corresponding equations. Proportional charts for laying out uniform scales are provided at the back of the book.

PERFORMANCE OF LUBRICATING OILS. (American Chemical Society Monograph Series.) By H. H. Zuidema. Reinhold Publishing Corporation, New York, N. Y., 1952. Bound, $6^1/_4 \times 9^1/_4$ in., 179 pp., charts, tables, illus., $5. With the emphasis on performance characteristics the several chapters consider in turn the process of lubrication, and such basic characteristics as the flow properties, oxidation, bearing corrosion, sludge and lacquer deposition, emulsification and foaming, and wear. Specific applications are not dealt with as such but only as illustrations. A final brief chapter on manufacturing methods is designed to show the effect of each step in the manufacture on performance characteristics.

THE PETROLEUM DICTIONARY. By Lalia Phipps Boone. University of Oklahoma Press, Norman, Okla., 1952. Bound, $6 \times 8^1/_2$ in., 338 pp., $5. This compilation contains more than 6000 words and expressions—both technical and nontechnical—which comprise the everyday language employed in the four major branches of the industry: exploration, production, pipelining, and refining. To these have been added names (and nicknames) of fields, wells, persons, and geological formations, as well as slang and specialized expressions native to the oil industry. A detailed introductory discussion of the "language of the oil field" precedes the main dictionary section.

PIPING DESIGN AND ENGINEERING. Grinnell Company, Inc., Providence, R. I., first edition, 1951. Bound, $9 \times 11^1/_4$ in., 221 pp., tables, diagrams, charts, graphs, $10. The plan of this book has been to compile in a single publication engineering data and technical information for the use of engineers engaged in the design and application of pressure-piping systems hitherto available only by consulting a number of sources. Major sections are as follows: expansion and stresses; velocity and pressure drop; pressure-temperature pipe graphs; piping materials; pipe fabrication; pipe hangers and supports; general tables.

REFRIGERATING DATA BOOK. Refrigeration Applications Volume. American Society of Refrigerating Engineers, New York, N. Y., third edition, 1951. Bound, $6^1/_2 \times 9^1/_2$ in., 894 + 224 pp., illus., tables, diagrams, charts, $6. Supplementing the basic volume which deals with refrigeration theory and design engineering, this manual covers the use of the science and art of refrigeration and the application of refrigerating machinery and associated equipment to solve the user's needs. Eight major sections are provided: frozen foods; cold-storage practice; refrigeration in food manufacture; refrigerated food distribution; low-temperature applications; industrial applications; comfort air conditioning; industrial air conditioning. A buyers' guide of refrigeration equipment is included.

REPORT ON THE ELEVATED-TEMPERATURE PROPERTIES OF STAINLESS STEELS. Under the auspices of the ASTM-ASME Joint Committee on Effect of Temperature on the Properties of Metals, prepared by Ward F. Simmons and Howard C. Cross. (ASTM Special Technical Publication No. 124.) American Society for Testing Materials, Philadelphia, Pa., 1951. Paper, $8^1/_2 \times 11$ in., 115 pp., graphs, tables, $4. This report is essentially a graphical summary of elevated-temperature data for the commercially produced stainless steels. Included are summary curves for tensile strength, 0.2 per cent offset yield strength, per cent elongation, per cent reduction of area, stresses for rupture in various time spans, and stress for various creep rates. An appendix contains, in tabular form, the primary data from which the curves were drawn, also the chemical composition, processing data, and other pertinent information about the steels.

SAMPLING INSPECTION BY VARIABLES. By Albert H. Bowker and Henry P. Goode. McGraw-Hill Book Company, Inc., New York, N. Y., first edition, 1952. Bound, $6^1/_4 \times 9^1/_4$ in., 216 pp., tables, graphs, charts, $5.50. This book presents a comprehensive set of sampling plans for use when inspection of the item is by variables and when the lot is to be evaluated in terms of its percentage defective. The plans may be used for both incoming and outgoing products and for goods in process. General principles, the construction of plans, and standard procedures are presented and detailed instructions are given for selection, installation, and operation. Illustrative examples and the necessary tables and charts for rapid application are included.

SCIENCE OF FLAMES AND FURNACES. By M. W. Thring. John Wiley and Sons Inc., N. Y., 1952. Bound, $5^1/_2 \times 8^3/_4$ in., 416 pp., tables, charts, diagrams, graphs, $6.50. This comprehensive treatise is intended to make available to furnace designers and operators the scientific knowledge that is pertinent and applicable to research on combustion and furnace problems. The major divisions are as follows: the function of a furnace; thermodynamics of furnace heating; liberation of heat by combustion; heat transfer under various conditions; aerodynamics of hot systems; science of furnace construction; application of the scientific method to furnace design and operation.

SMITHSONIAN LOGARITHMIC TABLES. To Base e and Base 10. (Smithsonian Miscellaneous Collections, vol. 118.) Prepared by George Wellington Spenceley and others. Smithsonian Institution, Washington, D. C. (publication 4054), 1952. Bound, $6^1/_2 \times 9^1/_4$ in., 402 pp., tables. Both natural and common logarithms, in respective sections, are given for all integers from 1 to 10,000 to 23 decimal places. For dealing with numbers of more than four significant digits additional columns are included giving the logarithms for the second and third of the factors into which the number must be broken up. The method of using these in computation is explained in an introduction which also indicates how a fourth factor is dealt with in the case of greatly extended decimals.

STRAIN GAUGES. Theory and Application. By J. J. Koch and others. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands (available in U. S., from Elsevier Press Inc., 402 Lovett Boulevard, Houston 6, Texas), 1952. Bound, $6 \times 8^3/_4$ in., 95 pp., illus., diagrams, $2.75. Prepared by the Netherlands Industrial Organization for applied Scientific Research and the Philips Industries, this study is for the use of both technicians and students. It deals with the construction and use of strain gages and measuring instruments for testing problems encountered in practical engineering and in the laboratory, and with the interpretation of values obtained. A chapter on stresses and the theories of failure is included.

ASME NEWS

With Notes on the Engineering Profession

ASME Plans Vigorous Program for 1952 Fall Meeting

Sheraton Hotel, Chicago, Ill., Sept. 7–11

THE Fall meeting of The American Society of Mechanical Engineers to be held in Chicago, Ill., Sept. 7–11, with headquarters at the Sheraton Hotel, presents an outstanding technical program. The program will represent the part ASME will play in its participation in the Centennial of Engineering.

Chicago Convention City

It is appropriate that Chicago should have been selected as the site for the Centennial. The growth of that city, since the holocaust of 1871 to its present status as second metropolis of this country and the fourth largest city in the world, is in itself a brilliant achievement in the field of engineering. Chicago was a pioneer in city planning, with the result that today the city reflects a spaciousness despite its position as a great railway and distribution center and a leading industrial city of the country.

Visits to the Chicago water works and filtration plants, the Congress Street Expressway, the Wacker Drive Extension, and city airports are indeed worth while. Culturally, it provides such diversions as the Art Institute of Chicago, the Chicago Natural History Museum, Adler Planetarium, the Museum of Science and Industry, and others too numerous to mention.

WATER TOWER, CHICAGO, ILL.

(A landmark of Chicago's Near North Side, it marks the northernmost extent of the Chicago Fire of 1871, which it survived. The choice of Chicago as the Centennial Convocation city is appropriate because its phenomenal development in the past 100 years from a frontier town to the second metropolis in the United States is in itself a mighty monument to engineering accomplishment.)

ASME participation in the Centennial consists of an unusually vigorous technical program with several attractive feature events. At 37 sessions, 97 papers will be presented. Sixteen professional divisions, three committees, and the American Rocket Society are co-operating with an able and active group of the Chicago Section Committee to make the meeting a memorable success.

All the events are open to members and nonmembers without registration fees. ASME and ARS headquarters will be at the Sheraton Hotel. All those planning to attend any part of the ASME Fall Meeting should register at the ASME Registration Desk located in the Ballroom Foyer on the seventh floor of the Sheraton Hotel.

The registration schedule is as follows: Sunday, Sept. 7, 10:00 a.m. to 5:00 p.m.; Monday, Sept. 8, 8:30 a.m. to 8:00 p.m.; Tuesday, Sept. 9, 8:30 a.m. to 5:00 p.m.; Wednesday, Sept. 10, 8:30 a.m. to 12:00 noon; and Thursday, Sept. 11, 8:30 a.m. to 3:00 p.m.

ASME members and guests are also urged to register for the Centennial of Engineering. The Centennial of Engineering Registration Desk is also located in the Ballroom Foyer on the seventh floor of the Sheraton Hotel. Each Centennial registrant will receive a souvenir badge, a copy of the Centennial master program, and have his name filed at a central registration point. The Centennial registration fee is $3.

Features of the Program

Sight-seeing drive and dinner at Edgewater Beach Hotel; the International Presidents' Luncheon, honoring presidents of engineering societies from other countries; Calvin W. Rice Lecture by Colonel Lyndall Urwick of London, "Management's Debt to the Engineer;" Gas-Turbine Power Luncheon and talk by Claude Seippel of Baden, Switzerland, "Gas Turbines in Our Country;" official visit to Centennial pageant, "Adam to Atom;" and Roy V. Wright Luncheon and Lecture by the Honorable Ralph E. Flanders, past-president and Hon. Mem. ASME, United States Senator from Vermont.

100 Years of Engineering Progress With Wood

Those attending the Centennial of Engineering should not fail to visit the outstanding industrial exhibits at the Museum of Science and Industry. This institution has been

called the "permanent world's fair" and employs the fresh display techniques that have proved so successful at this world-famous museum, where seeing is learning. Hundreds of industries are represented. Worth-while lessons can be learned from the graphic displays, which tell their story far more effectively than can the spoken or printed word.

It is of particular interest to the ASME Wood Industries Division, with two technical sessions on September 11, under the general title "One Hundred Years of Engineering Progress With Wood," that the hardwoods exhibit is the second largest at the Museum, occupying 10,000 square feet of floor space, costing over one third of a million dollars, and sponsored by nearly two hundred companies and individuals, from every segment of the hardwood industry. This exhibit will graphically tell the story of hardwoods, from the living tree, through the many manufacturing processes, to the final hardwood products. The hall featuring furniture will be the largest room of the exhibit, and will show modern and traditional designs. Visitors will learn how hardwoods offer them better living all through their lives.

Outstanding among the action displays in the Hardwoods Exhibit will be the animated model sawmill, veneer mill, and plywood plant. Manufacturers have underwritten the cost of scale models of their machinery that will simulate the actual woodworking operations being shown in a sound-color movie centered in the background of the display.

Among the convincing visitor-participation displays will be a large scale in the adhesives room which will demonstrate the strength of plywood and veneered furniture by weighing visitors with their entire weight supported by a thin layer of glue connecting clearly visible plywood links in the scale.

Another interesting visitor-participation unit will dramatize the acoustical qualities of wood in musical instruments. By manipulating the unit, visitors will learn how the resonance of wood reproduces sounds that cannot even be heard with other materials.

T. J. Connelly, Dean Company, and William C. Linn, Hoosier Veneer Company, are co-chairmen of the industry committee preparing the exhibit. The various sections of this nearly completed exhibit are under the supervision of Burdett Green, C. H. White, and W. C. Finley of the American Walnut Manufacturers Association; Charles Close of the Veneer Association; George N. Lamb, Mahogany Association; William Hunt, U. S. Plywood Corporation, and J. D. Urquhart, Rohm & Haas Company, with Thomas D. Perry, Fellow ASME, as technical consultant.

Committees

Following is a list of chairmen of committees in charge of arrangements: *Meetings*, R. H. Bacon; *General Committee*, B. H. Jenning; *Finance*, D. J. Bergman; *Hospitality*, A. B. Openshaw; *Hotel*, W. E. Walsh; *Inspection Trips*, W. H. Pletta; *Publicity*, S. I. Cole; *Reception*, F. A. Faville; *Registration*, Alf Kolflat; *Student Group*, S. E. Rusinoff; *Technical*, R. S. Hartenberg; and *Women's Activities*, Mrs. W. E. Walsh.

TENTATIVE PROGRAM

Available preprints of numbered papers may be purchased from ASME Order Department, 29 West 39th Street, New York 18, N. Y. Please order by number as listed in program. The tentative program follows:

MONDAY, SEPTEMBER 8

8:30 a.m.

Registration

9:30 a.m.

Cutting Fluids—Production Engineering (I)—Metal Cutting (I)

Vibrations in Knee-Type Milling Machines, by *Ivar Bendixen*, Technical University, Copenhagen, Denmark

Discontinuous Chip Formation, by *N. H. Cook, Iain Finnie,* and *M. C. Shaw*, Massachusetts Institute of Technology

9:30 a.m.

Rubber & Plastics (I)

To be announced

9:30 a.m.

Safety—Machine Design (I)

Elements of Machine Guarding, by *L. A. Faulkner*, Liberty Mutual Insurance Co.

Lighting as a Means of Promoting Safety, by *C. L. Crouch*, Illuminating Engineering Society

Organizing for Safety in a Small Plant, by *A. M. Baltser*, National Safety Council

9:30 a.m.

Power (I)

Steel Works Power Plants by *H. J. Benson,* and *R. W. Worley*, United Engineers and Constructors, Inc.

Operating Experiences With 1250 Gpm Demineralizer Water-Treatment Plant, by *D. N. Purcell* and *Vincent B. Burgess*, Philadelphia Electric Company

9:30 a.m.

Metals Engineering Symposium on Tolerances and Specifications of Castings (I)

Statistical Aspects of Specifications, by *Harold H. Johnson*, National Malleable & Steel Castings Co.

Tolerances and Specifications for Aluminum and Magnesium Castings, by *W. D. Stewart*, Aluminum Co. of America

Tolerances and Specifications of Precision Investment Castings, by *W. O. Sweeny*, Haynes Stellite Co.

12:15 p.m.

International Presidents' Luncheon Honoring Presidents of Engineering Societies From Other Countries

Presiding: O. W. Eshbach, President, Western Society of Engineers

Welcome: James D. Cunningham, Past-President and Fellow ASME

Response: Sir David Pye, President, The Institution of Mechanical Engineers, London, England

Speaker: The President, R. J. S. Pigott, Fellow ASME

Subject: **What Is Not Yet, May Be!**

WESTERN HEMISPHERE MANAGEMENT CONFERENCE

Under the auspices of the International Committee of Scientific Management (CIOS) with the Brazilian Institute of Management (IDORT), the Canadian Management Council, and U. S. A. National Management Council participating under the Administration of the Management Division of The American Society of Mechanical Engineers.

2:30 p.m.

Chairman: C. A. Peachey, President, Canadian Management Council

Opening of Conference by H. B. Maynard, Mem. ASME, President, International Committee on Scientific Management (CIOS)

Human Aspects of Industrial Engineering, by Ralph Presgrave, Assoc. ASME, Vice-President, J. D. Woods & Gorden Ltd., Toronto, Canada

5:00 p.m.

Calvin W. Rice Lecture

Presiding: R. J. S. Pigott, President and Fellow ASME

Speaker: Colonel L. F. Urwick, London, England

Subject: **Management's Debt to the Engineer**

6:15 p.m.

Management Dinner

Presiding: H. B. Maynard, Mem. ASME, President CIOS

Address by: Ruy Miller de Paiva, Representing President, Brazilian Institute of Management

8:30 p.m.

Round-Table Discussion Management Development in the Western Hemisphere

Moderator: A. M. Lederer, president, U. S. A. National Management Council

Panel Members	Representing
H. B. Maynard	International Committee on Scientific Management
Ruy Miller de Paiva	Brazilian Institute of Management
C. A. Peachey	Canadian Management Council
A. M. Lederer	U. S. A. National Management Council
E. H. MacNiece	ASME Management Division

2:30 p.m.

Petroleum

Recent Developments and Results of the Gas-Synthesis Demonstration Plant, Louisiana, Mo., by *J. H. Sandaker, R. G. Drassler,* and *J. A. Markovits*, Bureau of Mines. (No. 52—F-27)

Coal and Coal-Paste Preparation and Transfer Problems for Hydrogenation Service, by *H. A. Rammart, L. C. Skinner,* and *J. T. Donovan*, Bureau of Mines. (No. 52—F-26)

Corrosion and Erosion in the Synthetic Fuels Demonstration Plant, by *G. D. Gardner* and *J. T. Donovan*, Bureau of Mines. (No. 52—F-28)

2:30 p.m.

Production Engineering (II)—Metal Cutting (II)

Progressive Manufacture of Diesel Engines, by *Gordon Swardenski*, Caterpillar Tractor Co.

Contouring With Heavy Machine Tools, by *W. G. Wigton*, Giddings & Lewis Machine Tool Co., and *J. M. Delff*, General Electric Co.

2:30 p.m.

Nuclear Energy

Chairman: Alex D. Bailey, Hon. Mem. ASME, vice-president, Commonwealth Edison Co., Chicago, Ill.

Industrial Applications of Nuclear Energy, by *Alfonso Tammaro*, Chicago Operations Office, Atomic Energy Commission

2:30 p.m.

Rubber & Plastics (II)

Closed Mold Molding Techniques, by *E. F. Borro*, Durez Inc.

Mechanical Properties of Glass-Cloth Plastic Laminates as Related to Duration of Stress and

Construction of Laminate, by *Fred Werren*, Forest Products Laboratory

Effect of Preloading and Fatigue on Mechanical Properties of Glass-Cloth Plastic Laminates, by *Alan D. Freas*, Forest Products Laboratory

2:30 p.m.

Metals Engineering Symposium on Tolerances and Specifications of Castings (II)

Gray Iron Castings, by *Charles O. Burgess*, Gray Iron Founders' Society

Permanent-Mold Gray Iron Castings, by *Edward C. Hornicke*, Eaton Mfg. Co.

8:00 p.m.

Metals Engineering Symposium on Tolerances and Specifications of Castings (III)

Steel Castings, by *Charles W. Briggs* and *J. H. Lowe*, Steel Founders' Society of America

Malleable Castings, by *James H. Lansing*, Malleable Founders' Society

8:00 p.m.

Junior

Speaker: Kenneth W. Haagensen, director of public relations, Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

Subject: **Engineering—Opportunity Unlimited**

Guests of the Old Guard—Representing Sections:

Central Illinois George Gould	**Iowa-Illinois** R. F. French
Fort Wayne P. G. Campbell	**Rock River Valley** George L. Richardson
Milwaukee A. Simons	**Detroit** Witold Malinowski
Central Iowa Richard Parker	**St. Louis** J. C. Johnson

TUESDAY, SEPTEMBER 9

8:30 a.m.

Registration

9:30 a.m.

Hydraulic—ASCE (I)

Basic Problems in Unsteady Flow, by *George R. Rich*, Charles T. Main, Inc.

Water Tunnels for Hydraulic Investigations, by *J. M. Robertson*, The Pennsylvania State College

A second session on hydraulics cosponsored by the ASME Hydraulic Division and arranged by the Hydraulic Division of the American Society of Civil Engineers will be presented at 2:00 p.m., Sept. 9, at the Conrad Hilton Hotel during the Centennial of Engineering. Refer to the ASCE program for complete details.

9:30 a.m.

Production Engineering (III)—Metals Cutting (III)

Plastic Flow in Lead Extrusion, by *C. T. Yang*, Massachusetts Institute of Technology and *E. G. Thomsen*, University of California. (No. 52—F-18)

Some Observations on Chip Curl in the Metal Cutting Process Under Orthogonal Cutting Conditions, by *Robert S. Hahn*, The Heald Machine Co. (No. 52—F-16)

Deformation Work Absorbed by the Work Piece During Metal Cutting, by *E. G. Thomsen, J. T. Lapsley, Jr.*, and *Raymond C. Grassi*, University of California. (No. 52—F-24)

9:30 a.m.

Power (II)

The Outdoor Power Station in South Texas, by *H. G. Hiebsch*, Houston Lighting and Power Co.

Optimum Design for Surface Condensers for Steam Power Plants, by *J. T. Fong*, Burns & Roe, Inc.

Pressure Operation of Large Pulverized-Coal-Fired Boilers on the American Gas and Electric System, by *G. W. Bice* and *W. M. Yehnik*, American Gas and Electric Service Corp.

Railroad Tickets to Chicago in September

THERE will be heavy demands made on all transportation lines to Chicago for the Centennial of Engineering, September 3 to 13. Members everywhere should make their reservations immediately after reading this.

New York City (and vicinity) members may travel together on Special ASME Cars arranged for by ASME Headquarters.

New York Central—Commodore
leaving 5:30 DST Saturday, September 6, and Sunday, September 7, returning Thursday, September 11, and Friday, September 12, leaving Chicago at 3:30 p.m. DST
Phone Murray Hill 9-5400 and ask for Mr. T. N. Morris

One ASME car all bedrooms—one ASME car all roomettes.

Pennsylvania Railroad — Broadway Limited
leaving New York 6:00 p.m. DST Saturday and Sunday, September 6 and 7, Broadway Limited leaving Chicago 3:30 p.m. DST on Thursday and Friday, September 11 and 12

Two ASME cars on each of these trains (in each direction) all bedrooms.

Phone Pennsylvania 6-6000, Extension 2446, and ask for Mr. D. A. Kornhoff.

CAUTION — DON'T DELAY — RESERVE TODAY

9:30 a.m.

American Rocket Society (I)

Rocket Upper Air Research, by *Homer Newell, Jr.*, and *J. W. Siry*, Naval Research Laboratory

The High Altitude Sounding Rocket, by *Milton W. Rosen* and *Richard B. Snodgrass*, Naval Research Laboratory

Exposure Hazards From Cosmic Radiation at Extreme Altitudes and in Free Space, by *Hermann J. Schaefer*, School of Aviation Medicine

9:30 a.m.

Gas Turbine Progress Report—1952 (I)

Introduction, by *R. Tom Sawyer*, American Locomotive Co.

Materials, Cooling, and Fuels, by *A. A. Hafer*, Department of Navy

Thermodynamics, by *P. F. Martinuzzi*, Stevens Institute of Technology

Automotive, by *F. L. Schwartz*, University of Michigan

Railroad, by *K. A. Browne*, Chesapeake & Ohio Railway Co., *J. I. Yellott*, and *P. R. Broadley*, Locomotive Development Committee

Aviation, by *Ivan Driggs* and *O. E. Lancaster*, U. S. Navy

12:15 p.m.

Gas-Turbine Power Luncheon

Presiding: J. T. Rettaliata, president, Illinois Institute of Technology, Chicago, Ill.

Speaker: Claude Seippel, director of research, Brown Boveri Co., Baden, Switzerland

Subject: **Gas Turbines in Our Century**

2:30 p.m.

Gas Turbine Progress Report—1952—(II)

Marine, by *W. A. Dolan, Jr.*, and *A. A. Hafer*, Department of Navy
Merchant Vessels, by *W. A. Dolan* and *A. A. Hafer*, Department of Navy
Naval Vessels, by *W. A. Dolan* and *A. A. Hafer*, Department of Navy
Central Station, by *Lee Schneitter*, Ebasco Services, Inc.
Specialized Industrial Applications, by *L. N. Rowley*, McGraw-Hill Publishing Co. and *G. B. A. Skrotski*, McGraw-Hill Publishing Co.

2:30 p.m.

Production Engineering (IV)

Large Diameter Line Pipe—Its Production and Some Applications, by *W. C. Hoppe*, A. O. Smith Corp.

Die Castings, Engineering, and Production, by *J. C. Fox*, Doehler-Jarvis Corp.

2:30 p.m.

American Rocket Society (II)

The Satellite Vehicle, by *Wernher von Braun*, Redstone Arsenal

The Human Factor of Manned Rocket Flight, by *Heinz Haber*, University of California

WEDNESDAY, SEPTEMBER 10

8:30 a.m.

Registration

9:30 a.m.

Applied Mechanics (I)—ASCE (II)

The New Approach to Shell Theory—Circular Cylinders, by *E. H. Kennard*, David Taylor Model Basin, Navy Department. (No. 52—F-9)

A Nondestructive Differential—Pressure Test for Thin Shells, by *John C. New*, Naval Ordnance Laboratory. (No. 52—F-10)

The Forced Oscillation of the Centrifugal Pendulum With Wide Angles, by *F. R. E. Crossley*, Yale University. (No. 52—F-11)

Numerical Analysis of Forced Vibrations of Beams, by *N. O. Myklestad*, University of Illinois. (No. 52—F-12)

The Analysis of Fully Restrained Slabs Under Concentrated Loads (by Title), by *C. A. M. Gray*, University of Sydney. (No. 52—F-13)

This session is a continuation of four sessions arranged by the Engineering Mechanics Division of the American Society of Civil Engineers and co-sponsored by the ASME Applied Mechanics Division for presentation on Sept. 8-9 at the Conrad Hilton Hotel, during the Centennial of Engineering. Refer to the ASCE program for complete details.

9:30 a.m.

Gas Turbine Power (III)—IIRD (I)

The Development of Gas-Turbine Controls, by *G. Forrest Drake*, Woodward Governor Co. (No. 52—F-23)

The Application of Temperature Control to Turbojet Engines, by *J. F. Engelberger* and *H. W. Kretsch*, Manning, Maxwell & Moore Inc.

9:30 a.m.

Fuels

Influence of Low-Quality Coals on Design and Operation of Pulverized-Fuel-Fired Units, by *Otto de Lorenzi*, Combustion Engineering-Superheater, Inc.

Boiler Controls for Multiple-Fuel Firing in Modern Steam Generator Installations, by *Alfred C. Wenzel*, Republic Flow Meters Co.

9:30 a.m.

American Rocket Society (III)

Development Problems of the Ramjet for Supersonic Application, by *Jack O. Charshafian*, Curtiss-Wright Corp.

The Pulsejet as a Present-Day Power Plant, by *Brooks T. Morris*, Marquardt Aircraft Co.

On Stability and Control of Liquid-Propellant Rocket Systems, by *Y. C. Lee*, Aerojet Engineering Corporation

Experimental Performance of WFNA-JP-3 Rocket Motors at Different Combustion Pressures, by *M. J. Zucrow* and *Clair M. Brighley*, Purdue University

THURSDAY, SEPTEMBER 11

8:30 a.m.

Registration

9:30 a.m.

Materials Handling (I)

Material-Handling Factors Affecting Space Utilization, by *J. E. Wiltrabis*, Western Electric Company

Materials Handling in the Food Industry, by *R. H. Pratt*, General Foods Corp.

9:30 a.m.

Applied Mechanics (II)—ASCE (III)

Symmetric Turbulent Mixing of Two Parallel Streams, by *T. Paul Torda*, *W. O. Ackermann*, and *H. R. Burnett*, University of Illinois. (No. 52—F-14)

On Asymmetric Flow in an Axial-Flow Compressor Stage, by *W. R. Sears*, Cornell University. (No. 52—F-15)

This session is a continuation of four sessions arranged by the Engineering Mechanics Division of the American Society of Civil Engineers and co-sponsored by the ASME Applied Mechanics Division for presentation on Sept. 8-9 at the Conrad Hilton Hotel, during the Centennial of Engineering. Refer to the ASCE program for complete details.

9:30 a.m.

Heat Transfer (I)

Influence of Unheated Starting Sections on the Heat Transfer From a Cylinder to Gas Streams Parallel to the Axis, by *W. M. Tessin* and *Max Jakob*, Illinois Institute of Technology. (No. 52—F-21)

The Determination of Local Forced-Convection Coefficients for Spheres, by *J. R. Cary*, Douglas Aircraft Co. (No. 52—F-29)

An Investigation of Heat Transfer From an Inclined Flat Plate in Free Convection, by *Ben R. Rich*, Lockheed Aircraft Corp. (No. 52—F-20)

9:30 a.m.

Machine Design (II)—Lubrication

Critical Whirling Speeds of Shaft Disk Systems, by *Norman H. Jasper*, David Taylor Model Basin, Navy Department

On the Solution of the Reynolds Equation for the Slider-Bearing Lubrication—III, Effect of Transverse Curvature, by *A. Charnes*, *Sui-Chun Ying*, and *Edward Saibel*, Carnegie Institute of Technology

12:15 p.m.

Roy V. Wright Luncheon and Lecture

Presiding: R. J. S. Piggott, President and Fellow ASME

Lecturer: The Honorable Ralph E. Flanders, past-president and Hon. Mem. ASME, United States Senator from Vermont

Subject: To be announced

2:30 p.m.

Materials Handling (II)

Materials Handling at a Railroad Transfer Station, by *Allan B. Ward*, Mechanical Engineer

Wage Incentives for Materials-Handling Operations, by *Paul J. MacCutcheon*, The Nestle Company

2:30 p.m.

IIRD (II)

Theoretical Consideration of Retarded Control, by *Gerald H. Cohen* and *Geraldine A. Coon*, Taylor Instrument Company

Direct-Reading, Indicating Power Meter, by *Yao Tzu Li*, Massachusetts Institute of Technology. (No. 52—F-17)

Design of a Square Root Extracting Force Balance Pneumatic Flowmeter, by *Arnold Goldberg*, Goldberg Engineering Co.

2:30 p.m.

Heat Transfer (II)

Direct Graphical Evaluation of Radiation Form Factor "F," by *F. C. Hooper* and *Stephen Jubaan*, University of Toronto. (No. 52—F-19)

An Analysis of Laminar Free-Convection Flow and Heat Transfer About a Flat-Plate Parallel to the Direction of the Generating Body Force, by *S. Ostrach*, Lewis Flight Propulsion Laboratory

2:30 p.m.

Machine Design (III)

A Simple High-Speed Air Spinner for Centrifugal Testing of Small Mechanical Devices, by *C. F. Bild*, Sandia Corporation, and *P. F. Vial*, U. S. Naval Ordnance Laboratory

A Method of Obtaining Shear Stress-Strain Graphs by Interpretation of Moment Twist, by *Paul H. Kaar*, Armour Research Foundation

2:30 p.m.

Wood Industries (I)[1]

Plywood is Engineered Wood, by *Thomas D. Perry*, Fellow ASME, Moorestown, N. J. (No. 52—F-8)

Changes in Woodworking Machinery, by *Judson H. Mansfield*, Fellow ASME, Greenlee Bros. & Co.

From Handmade to Production-Line Furniture, by *Nelson C. Brown*, N. Y. State College of Forestry

History of Woodworking Industry, by *Fred F. Wangaard*, Mem. ASME, Yale School of Forestry, Yale University

8:00 p.m.

Wood Industries (II)[2]

Developments of Materials for Tools for the Cutting of Wood, by *E. K. Spring*, Henry Disston & Sons Co., Inc. (No. 52—F-25)

A Century of Engineering in Wood Preservation, by *George M. Hunt*, Consultant, Madison, Wis. (No. 52—F-22)

Waste Utilization, by *Armin Elmendorf*, Elmendorf Research, Inc.

Other meetings which will be of considerable interest to ASME members include the Conference on Manpower Utilization and National Security and the Wood Symposium.

The programs for these events follow:

Women's Program

Registration: Sheraton Hotel, Sept. 7-11, all day.
Sunday, September 7

3:00 p.m. The Chicago Section will provide cars to drive out-of-town ASME members, guests, and their ladies, north along the Lake front

5:00 p.m. Arrive at Edgewater Beach Hotel for reception and refreshments (compliments of Chicago Section, ASME)

7:00 p.m. Dinner, floor show, and dancing in the Marine Dining Room, Edgewater Beach Hotel.

Monday, September 8

12:00 Noon sharp Smörgåsbord luncheon and puppet opera
Kungsholm Restaurant
100 East Ontario Street

2:00 p.m. Puppet Opera (included with the luncheon)
Reservations limited to 150

Tuesday, September 9

11:00 a.m. Sight-seeing bus from Sheraton Hotel Tour—The Stock Yards and Packingtown

1:30 p.m. Luncheon at Armour Company
Movie
Demonstration and Talk

5:00 p.m. ASME Tour of the Museum of Science and Industry
East 57th Street and South Shore Drive

6:00 p.m. ASME Dinner at Museum

8:00 p.m. Special ASME performance of the Centennial pageant "Adam to Atom"
Special Reserved Seats for ASME members and guests

Wednesday, September 10

2:00 p.m. Tour—Marshall Field Company

Thursday, September 11

2:30 p.m. Card Party

CONFERENCE ON MANPOWER UTILIZATION AND NATIONAL SECURITY

Under the auspices of the Engineering Manpower Commission of Engineers Joint Council in cooperation with the Western Society of Engineers

SUNDAY, SEPTEMBER 7

10:00 a.m. Grand Ballroom
Conrad Hilton Hotel

Opening Session

Chairman: O. W. Eshbach, President, Western Society of Engineers, Member, Engineering Manpower Commission, Dean, Northwestern Technological Institute, Northwestern University, Evanston, Ill.

Manpower Utilization and National Security, by *Carey H. Brown*, Mem. ASME, Chairman, Engineering Manpower Commission.

Mr. Brown will highlight the position of the Engineering Manpower Commission of EJC with respect to such important manpower problems as Universal Military Training, Universal Military Service, Expanded R.O.T.C. proposals, Unified Reserve Legislation, Selective Service, and Industrial Utilization of Specialized Personnel in short supply.

Discussers

Dr. Arthur S. Adams, President, American Council on Education
Hon. William C. Foster, Deputy Director of Defense
Gen. Lewis B. Hershey, Director of Selective Service
Dr. Harry S. Rogers, Chairman, Engineers Council for Professional Development
J. E. Trainer, Firestone Tire & Rubber Co.

12:30 p.m. Conrad Hilton Hotel
Normandie Lounge

Luncheon

Provisions have been made for those attending the Manpower Conference to have lunch together in the Normandie Lounge. There will be no speaker.

2:00 p.m.

Open Forum

Those attending will have an opportunity to submit questions to a panel composed of the following:

Arthur S. Adams	Lewis B. Hershey
Carey H. Brown	A. C. Monteith
O. W. Eshbach	Harry S. Rogers
William C. Foster	J. E. Trainer

4:00 p.m.

Summary

Mr. A. C. Monteith, Mem. ASME, vice-president, Westinghouse Electric Corporation, will present a summary of the Conference.

[1] This session is Part II of the Wood Symposium being presented during the Centennial of Engineering and sponsored by the American Railway Engineering Association, American Society for Testing Materials, Structural Division of American Society of Civil Engineers, and the Wood Industries Division of The American Society of Mechanical Engineers. Parts I, III, IV, and V of Wood Symposium will be found elsewhere in this program.

[2] This session is Part III of the Wood Symposium being presented during the Centennial of Engineering and sponsored by the American Railway Engineering Association, American Society for Testing Materials, Structural Division of American Society of Civil Engineers, and the Wood Industries Division of The American Society of Mechanical Engineers. Parts I, II, IV, and V of Wood Symposium will be found elsewhere in this program.

WOOD SYMPOSIUM on One Hundred Years of Engineering Progress With Wood

Sponsored by American Railway Engineering Association, American Society for Testing Materials, Structural Division of American Society of Civil Engineers, Wood Industries Division of The American Society of Mechanical Engineers.

THURSDAY, SEPTEMBER 11

9:15 a.m. **Sherman Hotel**

Part I

(Arranged by ASTM Committee D-7 on Wood)

Chairman: L. J. Markwardt, U. S. Forest Products Laboratory, chairman, ASTM Committee D-7 on Wood

Wood as an Engineering Material, by *L. J. Markwardt,* U. S. Forest Products Laboratory

Basic Principles of Structural Grading, by *Lyman W. Wood,* U. S. Forest Products Laboratory

Working Stresses for Structural Lumber, by *R. P. A. Johnson,* U. S. Forest Products Laboratory

Commercial Lumber Grades, by *Frank J. Hanrahan,* Mem. ASME, National Lumber Manufacturers' Association

Principles of Guard Laminated Lumber Design, by *A. D. Freas,* U. S. Forest Products Laboratory

2:30 p.m. **Sheraton Hotel**

Part II

(Arranged by ASME Wood Industries Division)

Program for this session is listed under Wood Industries (I)

8:00 p.m. **Sheraton Hotel**

Part III

(Arranged by ASME Wood Industries Division)

Program for this session is listed under Wood Industries (II)

FRIDAY, SEPTEMBER 12

9:30 a.m. **Conrad Hilton Hotel**

Part IV

(Arranged by the ASCE Committee on Timber Structures of ASCE Structural Division, and AREA Committee 7 on Wood Bridges and Trestles)

Chairman: George E. Brandow, Consulting Engineer, Brandow & Johnston; C. G. Grove, Pennsylvania Railroad.

Railways, by *H. Austill,* Terminal Railroad Association of St. Louis

Industry, by *Clarke C. Heritage,* Weyerhaeuser Timber Co.

Ships, by *A. E. Luders, Sr.,* Luders' Marine Construction Company

Shore Structures

Advancements in Technical Abilities, by *Rear Admiral Albert D. Alexis,* Director of Atlantic Division, Navy Bureau of Yards and Docks

Improvements in Structures, by *Charles A. Chaney,* Navy Bureau of Yards and Docks

2:30 p.m. **Conrad Hilton Hotel**

Part V

(Arranged by ASCE Committee on Timber Structures of ASCE Structural Division)

Chairman: Howard J. Hansel, Illinois Institute of Technology

Highways, by *Raymond Archibald,* U. S. Bureau of Public Roads

Structural Fabrication, by *Ward Mayer,* Timber Structures, Inc.

Schools, by *Harry W. Bolin,* California State Division of Architecture

Buildings, by *William H. Scheick,* National Research Council.

Centennial of Engineering 1852–1952

STARTING in late July and continuing over a year, millions of people are to be given a firsthand demonstration of those technical, economic, and social factors that make America tick. This outstanding exhibit will be one of the starting features of the Centennial of Engineering to be held in Chicago, Ill., this summer. It will occupy the balcony of the East Court of the spacious Museum of Science and Industry, on Chicago's lake front.

Hailed by Herbert Hoover, Charles F. Kettering, General Motors research authority, and leaders in science and education as an unusual opportunity to depict what actually underlies America's high standard of living, the exhibit will show basic factors which contributed to our national growth. Industrial exhibits costing millions of dollars and now existing at the Museum will reinforce its general story.

The Centennial of Engineering exhibit will occupy 10,400 sq ft of floor space. The exhibiting firms with the high lights of their exhibits are as follows: Westinghouse Electric Company will supply an electric staircase which will carry visitors effortlessly to the balcony area where they will be introduced to the story of one hundred years of progress through engineering.

Aluminum Company of America has developed a new construction technique to utilize the peculiar advantages of aluminum as a structural material which will be graphically demonstrated by an animated model in which the visitor will see buildings rise from the ground in stages.

International Harvester Company will demonstrate the significance of mechanized farming.

Stewart-Warner Corporation will illustrate the importance of lubrication to modern machinery.

The Link-Belt Company will show that the old slogan of the medical supply houses, "untouched by human hands," is becoming true in every type of industry, because machines can move material as well as change its shape, and can do it quicker and with less effort.

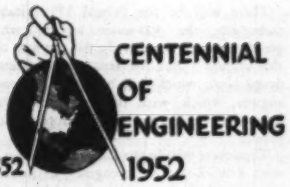
General Motors will demonstrate how radically the tempo of our national life has changed.

The world's largest lighting unit, a 50-thousand-watt lamp, as well as the world's smallest lamp, especially made for surgical purposes, will be the focal attractions of the General Electric Company's section. The exhibit will trace the history of man's effort to see in the dark, and show some of the great variety of lamps available for every specialized need today.

The Civil Engineer's Corps of the U. S. Navy will exhibit several units tracing the history of that organization, and showing how valuable engineering progress has been in the defense of our country. Great advances will be shown in both temporary and permanent facilities for repairing ships and for protecting men and materials from attack. Several examples will also be given of the artistic care used in early engineering drawings.

The Cincinnati Milling Machine Company will tell the story of the industry upon which all others depend—the machine-tool industry. It will stress how much depends today on interchangeability of parts and what this means in time and labor saving and making industrial goods less costly to buy. The final stage of the exhibit shows a machine cutting

A VIEW OF THE WESTERN SOCIETY OF ENGINEERS LOUNGE, CHICAGO, ILL.



a die for the production of an ash tray, and, next to it, another machine which will actually produce ash trays so that the visitor may see just how each step works, and he may acquire one as a souvenier.

The Centennial of Engineering, 1952, Inc., will install a guide panel indicating where the subjects shown in the exhibit may be studied in additional detail in other parts of the Museum.

Centennial Pageant

Fittingly titled "Adam to Atom," a spectacular musical show will be presented to the public and staged in Chicago this summer as one of the principal features of the Centennial of Engineering, 100th anniversary celebration of the founding of the first professional engineering society in the United States.

The musical extravaganza will dramatically portray in colorful and highly entertaining tones, the panorama of mankind's advance by the utilization of engineering and scientific achievements. With a large cast depicting over 300 character roles in twenty-seven fast-moving scenes, the gripping story of man's rise will be recounted from the days of the earliest cavemen right up to the present moment of the conversion of atomic power.

Committee Members

The Centennial commemorating the founding 100 years ago of the first society of civilian engineers in this country opened July 12 with public events and will terminate from September 3 to 13 in the greatest convocation of engineers ever held anywhere in the world. Participating will be 61 American engineering societies and delegations from the leading countries of Asia, Europe, and Latin America.

Two more members have been added to the board of directors of the Centennial of Engineering which already had included numbered among its personnel, 37 of the nation's foremost scientific and engineering figures, including Herbert Hoover, Hon. Mem. ASME, and Charles F. Kettering, Fellow ASME, wizard of the automobile world.

The latest additions are Alva W. Phelps, Mem. ASME, chairman of the Oliver Corporation; and Harry A. Winne, Fellow ASME, N. Y., vice-president of the General Electric Company.

Nationalist China to Be Represented

The Nationalist Chinese Government will send two official delegations from its headquarters on Formosa. This makes 16 foreign nations that will be represented by their leading scientists and engineers.

One of the Chinese groups will represent the Chiang Kai-shek Ministry of Economic Affairs, and the second, the Chinese Institute of Engineers.

There will be five members in the former, headed by Hung-hsun Ling, chairman of the board of the Chinese Petroleum Corporation. The second group will have 13 members, with S. Shee Wang, of the Taiwan University faculty, as chairman.

South America will send 150 to the celebration. They will come for the international convocation, many of whom will be in the United States of the UPADI conference to be held in New Orleans, La., Aug. 25-30.

Cornell Society of Engineers

On Friday, September 5, under the sponsorship of The Cornell Society of Engineers and during the celebration of the Centennial of Engineering in Chicago, Cornell Engineers will gather from all over the country. The program will start at 4 o'clock at the Lake Shore Club in Chicago, with a talk by C. C. Furnas, Mem. ASME, director of the Cornell Aeronautical Laboratory in Buffalo, N. Y., on "Future Trends in Aviation." After this meeting cocktails will be served preceding dinner at 7 o'clock, after which Dean S. C. Hollister, Mem. ASME, of the Engineering College at Cornell will speak on "Outlook for Engineering Education."

300 Leading Scientists Attend ASME Applied Mechanics Sessions

MORE than 300 of the nation's top research engineers participated in a symposium on "Shock and Vibration Instrumentation," an outstanding feature of the 17th National Applied Mechanics Division Conference of The American Society of Mechanical Engineers which was held at The Pennsylvania State College, June 19-21, 1952, in co-operation with the ASME Central Pennsylvania Section.

Leading scientists from the Bureau of Standards, Naval Research Laboratory, Wright Air Development Center, and other important research centers took part in this event, which was deemed by authorities to be one of the most successful of its kind in recent years.

The technical program was presented at ten sessions and a formal inspection of the Garfield Thomas Water Tunnel, as well as detailed inspections of various research projects, was conducted by J. A. Sauer and Joseph Marin, of the department of engineering mechanics.

The banquet, held at the Nittany Lion Inn, was attended by 196 guests. A. O. Morse, Provost of The Pennsylvania State College, welcomed the group to the campus. C. E. Davies, secretary, ASME, spoke briefly, followed by R. E. Peterson, toastmaster of the banquet, who introduced some of the guests.

Eric A. Walker, dean of the school of engineering at the College, spoke on the topic "Sources of America's Might." In the course of his talk he discussed current research and development programs under way in this country and their relation to our defense needs. He stressed the growing need of personnel properly trained to conduct today's research and means of increasing the supply of such men to carry on the programs.

Another enjoyable event of the meeting was a buffet supper and cocktail hour at the Centre Hills Country Club, which was attended by more than 200.

R. L. Stanley, general chairman of the local committee, was in charge of the local arrangements.

Power Show Concentrates on Improved Equipment

MAJOR improvements in power equipment to be seen at the 20th National Exposition of Power and Mechanical Engineering, to be held in Grand Central Palace, New York, N. Y., Dec. 1 to 6, 1952, will reflect a marked trend toward the fully automatic generating station. The automatic power plant is a reality already, but its recognition by the engineering profession as a basic element in design is a new development that is entering into long-range planning, spurred by the continuing expansion of power demand.

Feedback, coupled combination controls for the entire equipment of the central station, or industrial power plant have been in use for several years as auxiliaries for existing units, but the multiplication of new equipment in this new line, and its rapid assimilation by engineers have led to a new line of thinking, in which future plants are being planned from the beginning as completely integrated units. Many new exhibits at the Power Show will disclose innovations designed to fit advanced concepts of the unified power plant.

Automatic power generation is compatible with the rapid advance of automatic process control, for which much of the equipment at the exposition has also been developed. Coincidentally this double-headed movement in the instrument field has given rise to a whole new vocabulary of terms, which is at present under review by ASME, under whose auspices the exposition is being held, in conjunction with the Annual Meeting of ASME, Nov. 30-Dec. 5.

VIEW OF APPLIED MECHANICS BANQUET, THE PENNSYLVANIA STATE COLLEGE, JUNE 19, 1952

IIRD Conference Planned for September 9–10

A SYMPOSIUM entitled "High-Pressure Measurements," conducted by the Industrial Instruments and Regulators Division of The American Society of Mechanical Engineers, is scheduled as one of the features of the Seventh National Instruments Conference and Exhibit sponsored by the Instrument Society of America, to be held in Cleveland (Ohio) Auditorium, Sept. 8–12, 1952.

The conference and exhibit will cover such subjects as instruments and devices for measurement, inspection, testing, and automatic control.

The IIRD symposium will represent a significant step in the disclosure of high-pressure studies. The IIRD members are planning to use the Statler Hotel as their headquarters.

The tentative IIRD program for technical sessions follows:

TUESDAY, SEPTEMBER 9

Symposium on High Pressures

9:30 a.m.

Introduction to the Symposium on Measurement of High Pressures, by *Percy W. Bridgman*, Harvard University

The Piston Gage as a Precise Pressure Measuring Instrument, by *Daniel Johnson*, National Bureau of Standards, and *Donald H. Hewhall*, Harwood Engineering, Inc.

A High-Pressure Wire Gage Using Gold-Chrome Wire, by *Horace Darling*, The Foxboro Company

2:30 p.m.

An Application of High Pressure in Geophysics: Experimental Rock Deformation, by *John Handin*, Shell Oil Company

Techniques and Equipment for the Generation of Dynamic High Pressures, by *E. J. Mickerica*, U. S. Naval Ordnance Laboratory

A High-Speed, High-Pressure Gage, by *P. L. Edwards*, U. S. Naval Ordnance Laboratory

Design of High-Pressure Pumps, by *R. W. Hiteshue*, U. S. Department of the Interior, Bureau of Mines

A Sensitive Pressure Controller for High-Pressure Service, by *P. L. Golden* and *A. F. Headrick*, U. S. Department of the Interior, Bureau of Mines

WEDNESDAY, SEPTEMBER 10

9:30 a.m.

Summary Paper—**"High-Pressure Developments at Yale University,"** by *Barnett Dodge*, Yale University

Influence of Residual Stress on Behavior of Thick-Wall Closed-End Cylinders, by *J. H. Faupel* and *A. R. Furbeck*, E. I. du Pont de Nemours & Co., Inc.

Rupture Disk Design Evaluation and Bursting Tests, by *G. R. Prescott*, E. I. du Pont de Nemours & Co., Inc.

Panel Discussion: **Safety Precautions in High-Pressure Operation**

2:30 p.m.

Gaskets for High-Pressure Vessels, by *Andrew R. Freeman*, American Instrument Co., Inc.

Design and Application of Controlled Volume Pumps for High Pressures, by *Donald H. Jones*, Milton Roy Company

Seals to Minimize Leakage at Higher Pressures, by *B. A. Niemeier*, Experiment Incorporated

A Static-Dynamic Load Machine for High Pressure, by *E. T. Fleischhauer* and *E. G. Dorsey, Jr.*, Experiment Incorporated

For IIRD abstracts of papers write to W. H. Howe, chief engineer, The Foxboro Company, Foxboro, Mass.

Two other features of importance and interest are the Fourth Preconference ISA Instrument Maintenance Clinic, Sept. 5–7, and the new Analysis Instrumentation Clinic, Sept. 8–12.

Coming Meetings

Combustion

PLANS for the 1952 International Symposium on Combustion, to be held at the Massachusetts Institute of Technology from Sept. 1 to 5, 1952, have been announced by the symposium committee. The Symposium will be open to all who are interested in combustion.

Since the last symposium was held in 1948, the accelerated pace of combustion research throughout the world has yielded an important body of new knowledge. Much of this new knowledge will be presented at the symposium in some 100 papers from Great Britain, France, Holland, Belgium, Germany, and Japan as well as from the research laboratories and educational institutions of the United States. At least 50 foreign authorities in the field will attend.

Papers are now being reviewed by a Papers Subcommittee of the General Symposium Committee of 68 American and 12 foreign members. Emphasis is being placed on the physical aspects of combustion, particularly wave phenomena and turbulence, treated from both experimental and theoretical standpoints.

Typical fields in which papers will be presented are ignition; stabilization in laminar and turbulent flow; limits of inflammability and detonability; instability phenomena; microstructure of combustion waves; theory of flame propagation; flamejet structures; and combustion processes in rocket systems.

In addition to these fields, plans have been made for several survey papers and round-table discussions on special topics.

The complete papers will appear later in a single volume, similar to that issued after the 1948 Symposium. This volume, roughly 750 two-column pages, should constitute an important reference work in the field of combustion. Its partial subsidy by American industry will permit its prepublication sale at a relatively low price.

Requests for registration forms or for further information on the symposium should be addressed to Summer Session Office, Attention: Combustion Symposium Committee, Massachusetts Institute of Technology, Cambridge 39, Massachusetts, or to Prof. Hoyt C. Hottel, Mem. ASME, Professor of Fuel Engineering at M.I.T. and co-chairman of the Symposium.

British Jets at Farnborough

THE display of many of Britain's new jet aircraft will be a high spot in this year's British air show to be held at Farnborough, England, from September 2 to 7.

There will be the Bristol 175 Britannia turboprop, the 100-seater airliner whose prototype is expected to fly for the first time this summer. And the Saunders Roe Princess flying boat, which will have the Proteus II engines, which, with the Proteus III, have been developed by the Bristol Aeroplane Company.

Then there will be the long-range Comet 11, with Rolls-Royce Avon engines, destined for transatlantic flights, which should bring New York to within six or seven hours of London in regular passenger schedules. Reports from Britain also indicate that A. V. Roe may show the new Avro jet bomber.

The annual Farnborough Flying Display and Exhibition, organized by the Society of British Aircraft Constructors, gives airline executives, government representatives, high ranking Service officers, and other invited guests from overseas an opportunity to see the latest products of British aeronautical-engineering skill.

During the first four days the show will be open to the Society's invited guests. For invitations and further information, application should be made to the Society of British Aircraft Constructors, Ltd., 32 Savile Row, London W.1, England.

Safety Conference Calls for Redoubled Action to Save Lives in Industry

FIFTEEN hundred delegates to the President's Conference on Industrial Safety heard President Truman call for additional effort to combat work accidents in order to conserve manpower for defense production at the 1952 session held June 2–4, 1952, in the Departmental Auditorium, Washington, D. C.

"Due to our defense program," the President told the conference, "thousands of new workers were brought into defense plants and other industries. Thousands of other workers shifted from their old to new jobs. With the changed conditions, the number of work accidents began to increase. They increased four per cent in 1950 and another nine per cent in 1951. This increase is a very serious matter. We must do everything we can to stop it. We must see to it that the accident rate starts downhill again and that it keeps on going down."

In his address to the conference the President suggested an eight-point program of action to redouble efforts to reduce work accidents.

The eight points were: better accident reporting and analysis; better machine guarding at the source of manufacture; safety education in schools, colleges, and plants; a safety organization in every company; greater worker participation in safety; greater uniformity and modernization of State safety codes; more public employee safety; and better public understanding and support of accident prevention.

Workshop discussions were held on the subject of trade-association activity in the field of industrial safety and Secretary of Labor

Maurice J. Tobin, General Chairman of the President's Conference, praised the delegates for the accomplishments of past years and called for greater effort by both management and labor to curb the rise in industrial accidents.

Accomplishments in developing State safety programs were outlined in a discussion by executives of Governors' Conferences on Industrial Safety.

Ned H. Dearborn, president of the National Safety Council, discussed the problem of reducing accidents in small firms, plants, and business establishments. Vincent P. Ahearn, executive secretary, National Sand and Gravel Association and Executive Director for the President's Conference acted as co-chairman of the conference with William L. Connolly, Director of the U. S. Department of Labor's Bureau of Labor Standards who is Chairman of the Co-Ordinating Committee of the President's Conference.

Special awards of merit were presented by Secretary Tobin to past and present conference committee chairmen and to several special consultants to the conference. Among the recipients of awards were: Dean C. W. Beese, Mem. ASME, and James E. Trainer, Fellow ASME.

Material Handling Institute Sponsors Series of Unique Conferences

THE billion-dollar material-handling industry is applying an unusual conference technique to the solution of management problems confronting material-handling equipment users.

To accomplish this end, The Material Handling Institute is conducting conferences of management leaders in various phases of the industry. Specific problems are posed and threshed out across a table by representatives of the manufacturers and of users of their products. To avoid unwieldiness, attendance is limited to small working groups.

Already, the Institute has sponsored two conferences; one in Pittsburgh, Pa., concerning dry bulk handling and another in Chicago, Ill., dealing with scrap handling. Each of these conferences was conducted on a workshop-clinic basis where operating executives representing varied production activities presented problems characteristic of their particular operations.

In reply, engineering or application specialists proposed solutions to particular problems in terms of the type of material-handling equipment each specialist represented.

In addition to active participants, editors from leading technical and business publications attended as observers.

The value of these conferences to industry dictated a series to be held at regular intervals on different subjects. Although attendance is by invitation only, one may request the opportunity to be represented at future conferences by writing directly to The Material Handling Institute, 1108 Clark Building, Pittsburgh, Pa.

ASHVE Semi-Annual Meeting in Spring Lake, N. J., Well Attended

TWENTY-NINE states and two provinces of Canada were represented in the attendance of 476 members and guests at the 1952 semi-annual meeting of The American Society of Heating and Ventilating Engineers at Spring Lake, N. J., June 16–18, in the Essex and Sussex Hotel. A total of ten papers dealing with heat-flow and heat-transfer problems, research in room-air distribution, air filtering, and air drying, were presented at three technical sessions.

Addresses by George F. Smith, president of Johnson & Johnson, New Brunswick, N. J., and Col. William G. McKinley, member of the National Executive Committee of the American Legion and past commander of Hudson County, N. J., provided two of the high lights of the meeting.

Mr. Smith, who spoke at the "Welcome Luncheon" on the opening day, described some of the problems that were surmounted in the construction of the New Jersey Turnpike, justifying the faith of its backers from both a financial and traffic viewpoint. Mr. Smith is vice-president of the Turnpike Authority.

Col. McKinley, a staff engineer for the New York Telephone Co., delivered the banquet address. Taking as his topic a matter that is receiving the increasing attention of leaders of the engineering world, Col. McKinley spoke on "The Engineer as a Citizen." He held forth forcefully on the vital importance of the engineer taking an active part in community life in fulfillment of his duty as a citizen and a professional man.

A number of technical advisory committees held meetings and the results of their planning will be reflected in the work of the society. ASHVE President Ernest Szekely, Mem. ASME, presided over the first technical session on June 16.

Education

Standardization

A FELLOWSHIP for conducting systematic studies of standardization and its applications in science, engineering, production, and marketing has been announced by Dr. Edward R. Weidlein, president, Mellon Institute, Pittsburgh, Pa. This fellowship will be sustained at the Institute by a grant from the Sarah Mellon Scaife Foundation of Pittsburgh, and its projects will be organized and supervised by Dickson Reck, Advisory Fellow. Dr. Reck will work in co-operation with research specialists of the Institute and with national authorities and societies.

Grease Research

METHODS of improving lubricating grease which may enable car owners to lengthen the period between grease jobs and which may improve the special greases required for Army tanks and air force jet planes are being studied at the engineering laboratories of the University of Oklahoma.

New machinery developed by Morehouse Industries of Los Angeles, sponsors of the project and pioneer manufacturers of specialized grinding and processing mills, has been supplied to the fuels and lubricants laboratory of the university and may well prove the answer to the production problems involved. The current program will deal with all phases of the milling of greases in order to learn as much as possible what changes take place under such action.

First project under study is the production of lithium hydroxy stearate greases. Morehouse Model B-1405, high-production grease mill, will be used in the project.

Institute of Nuclear Studies

THE Atomic Energy Commission and the Oak Ridge Institute of Nuclear Studies, Inc., have signed a contract, effective July 1, 1952, for the Institute to continue its operation of certain programs for the AEC for another five years.

Founded October 15, 1946, with 14 charter member universities, the ORINS utilizes some of the unique atomic-energy facilities here to carry out research and training in the nuclear sciences.

The basic purposes of the Institute are (1) to stimulate co-operation between the government and participating universities, in undertaking fundamental research in atomic energy; (2) foster increased opportunities and improved programs of graduate study and education in nuclear energy in educational institutions of this region; (3) aid in acquisition and training of scientific personnel, and (4) utilize Oak Ridge's unique facilities for graduate research and instruction.

Specialized programs carried on by the ORINS include: The conduct of a series of courses in the safe and efficient handling of radioactive isotopes; the operation of a long-range research program on the treatment of malignant diseases, with emphasis on the effects of radiation and the effects of radioactive materials on these diseases; and the operation of the American Museum of Atomic Energy, together with its traveling exhibits.

The Institute also sponsors several programs co-operatively with the Oak Ridge National Laboratory, which is operated by Carbide and Carbon Chemicals Co., and administers the AEC-sponsored fellowship program on a nationwide basis.

Industrial Engineering

THE Fourth Annual Industrial Engineering Conference sponsored by industrial-engineering section, mechanical-engineering department, Michigan State College, will be held Sept. 8–12, 1952. The 1952 conference will be based on the theme, "Industrial Engineering—the Key to a Dual Economy." Because the dual program was such a success last year, the plan will be followed again this year, namely, a general conference on Monday and Tuesday, and workshop meetings, on Wednesday, Thursday, and Friday.

Cincinnati Host to 1952 ASME Semi-Annual Meeting, June 15–19

Meeting Attracts Large Audience

IN addition to a four-day technical program of 38 sessions at which more than 80 papers on a wide variety of subjects were presented and discussed, the 1952 Semi-Annual Meeting of The American Society of Mechanical Engineers, held at the Sheraton-Gibson Hotel Cincinnati, Ohio, June 15–19, 1952, featured a four-session meeting of the Council (see page 697), a business meeting, the Regional Delegates Conference, numerous sessions of the National Nominating Committee, a number of plant visits, and a program of social events for the women in attendance. Several ASME committees also took advantage of this occasion to hold important meetings.

The total registration was approximately 1300 members and guests.

Frederick S. Blackall, jr. Nominated for President

Frederick S. Blackall, jr., president and treasurer, Taft-Peirce Manufacturing Company, Woonsocket, R. I., was nominated for the office of President of ASME for the administrative year 1952–1953. Vice-presidents nominated were: Henry R. Kessler (renomination), Region II, manager, Republic Flow Meters Company, New York, N. Y.; Paul R. Yopp, Region IV, district sales manager, The Babcock & Wilcox Company, Atlanta, Ga.; Ben George Elliott, Region VI, professor of mechanical engineering, University of Wisconsin, Madison, Wis.; and Harry R. Pearson, Region VIII, personnel manager, Dallas Power and Light Company, Dallas, Tex. Directors at Large nominated were: David W. R. Morgan, vice-president, Westinghouse Electric Corporation, Philadelphia, Pa.; and Ralph L. Goetzenberger, vice-president, Minneapolis-Honeywell Regulator Company, Washington, D. C. Brief biographies of these nominees will be found on pages 689–691 of this issue. Official ballots will be mailed to members later in the summer.

1953 Nominating Committee Elected

At the brief business meeting which was held on June 16, it was announced that the 1953 Semi-Annual Meeting would be held at Los Angeles, Calif., June 28–July 2, with headquarters at the Hotel Statler. The Secretary read the nominations offered by the Regions for the National Nominating Committee for 1953. See page 691 of this issue.

Technical Program

A total of 86 papers covering almost every field in mechanical engineering was presented at the 38 scheduled technical sessions. The 21 ASME Divisions and Committees that participated in the program covered such fields as hydraulics, gas-turbine power, fuels, petroleum, education, machine design, lubrication, metals engineering, process industries, effect of temperature on metals, power, production engineering, metal cutting, cutting fluids, railroad, heat transfer, industrial instruments and regulators, management, materials handling, and aviation.

In addition co-sponsoring groups included the American Society for Testing Materials, American Society of Lubricating Engineers, Society for the Advancement of Management, American Institute of Industrial Engineers, and Engineering Society of Cincinnati.

Of particular interest was a fuels session devoted to the problem of preventing air pollution, dealing with the design, installation, and application of fuel-burning equipment. At a power session the selection and training of power-plant personnel came under close scrutiny.

The increasing shortage of engineers of mounting concern to the technical world was the subject of a panel discussion entitled, "Engineering Manpower Problems." And at a Junior Session three speakers delved into the question of what industry has to offer the young engineer.

In machine design, papers covered such subjects as a high-speed surface-broaching machine, which increases production at lower costs, and machine-tool lubrication.

Some of the other technical sessions discussed features and facilities of various new steam-power plants, metals and metal processing in the atomic-energy field, the use of radioactive isotopes as tracers to measure the "instantaneous" rate of tool wear, development, and performance of gas-turbine combustors, developments in railroad metallic and rubber draft gears, automatic-control instrumentation, the economics of choosing new machinery and equipment and developments in automation, a new method of applying the cutting fluid to the tool bit, and recent developments in materials-handling techniques.

Digests of 30 ASME Semi-Annual Meeting papers have been published in MECHANICAL ENGINEERING, June, 1952, pages 503–507; and July, 1952, pages 589–593. Twenty additional digests of Semi-Annual Meeting papers can be found on pages 665–670 in this issue.

President's Luncheon

More than 250 ASME members and guests attended the President's Luncheon on Monday, June 16, and heard R. J. S. Pigott, President of ASME, speak on the position of the engineer today. Mr. Pigott pointed out that while we automatically think that research is done by scientists, actually more of it is done by engineers. The pure scientist can readily go into research immediately on finishing his formal training. Not so the engineering graduate; he is short on basic science and has not yet had practical experience. He should work at his profession five or ten years, enlarging his empirical knowledge, before he can be considered ready for research, he said.

An important advantage of engineering training, Mr. Pigott added, is that it is useful even when the engineer goes entirely outside his professional field. The methods of thought and the habitual consideration of facts, first of all, are useful whether a man is selling dry-goods or managing a bank. A patent lawyer today cannot do an effective job without engineering background.

Two years ago, Mr. Pigott said, a Federal

SEEN AT THE PRESIDENT'S LUNCHEON ARE, *left to right*, ASME PRESIDENT R. J. S. PIGOTT GEORGE H. LARKIN, GENERAL CHAIRMAN OF THE SEMI-ANNUAL MEETING, AND THE HONORABLE CARL W. RICH, MAYOR OF CINCINNATI

bureau published a disastrous pamphlet discouraging engineering registration. As a result, engineering registration declined and we are now paying the bill. There is now a shortage of about 25,000 engineers, with college registration down to one half in many schools. By 1954 or 1955 we shall be perhaps 60,000 short, he said. But in the long run this situation may turn to the advantage of the engineering profession. An engineer is never so much appreciated as when we can't get one. Consequently the young graduate does not have to look for a job now; the job is seeking him. This condition is good in one way and bad in another. It can be observed that in many cases the student is distinctly feeling that the "world owes him a living." This attitude was started by a paternalistic government and is increased by the present ease of getting a job. It is bad and will have to be corrected, Mr. Pigott declared. But on the other hand, the high rates now bid for engineers not only help the new graduates but more slowly affect the older experienced men, either by direct offers or by necessary adjustment to keep the balance in any particular organization. The over-all result, Mr. Pigott stated, will be an improvement in the engineer's financial position relative to the other activities.

On hand to welcome the ASME to Cincinnati was the Honorable Carl W. Rich, Mayor of the city. Pointing out that Cincinnatti was the second oldest city in Ohio, Mayor Rich gave a brief history of the city's founding and how it derived its name. He cited Cincinnati's cultural activities and described some of the city's industrial achievements, pointing out that Cincinnati is one of the world's greatest machine-tool centers.

As part of the luncheon program, President Pigott presented an ASME Fellowship Certificate to J. Calvin Brown, past-president ASME.

George H. Larkin, Mem. ASME, district manager, Hagan Corporation, Cincinnati, Ohio, presided.

Roy V. Wright Lecture

The requirement for more and more engineers in the United States constitutes one of the most important problems of our national security requiring an urgent solution, William C. Foster, Mem. ASME, Deputy Secretary of Defense, Washington, D. C., said in delivering the Roy V. Wright Lecture on Monday. Looking at our past achievements with justified pride, he declared, we have taken our engineering ability for granted and assume that the leadership which we have exercised in this field for so many years will remain unchallenged.

These are no times for selfish satisfaction, Mr. Foster pointed out. It is estimated that Soviet Russia graduated almost as many students from technological schools this year as the United States. Our supply of engineers and scientific manpower is a limited one and it can be expanded only slowly. Thus in the critical period ahead, the lecturer stated, any effective increase in the availability of engineering and scientific skills must come from better utilization of our existing resources in industry as well as in government. (The complete text of the Wright Lecture will be published in a forthcoming issue of MECHANICAL ENGINEERING.)

WILLIAM C. FOSTER, *left*, THE ROY V. WRIGHT LECTURER, ENJOYS CHAT WITH PRESIDENT PIGOTT

ASME president, R. J. S. Pigott, presided at the lecture.

ESC-ASME Joint Luncheon

At the joint ESC-ASME Luncheon on Tuesday, Walter W. Tangeman, Mem. ASME vice-president, Cincinnati Milling Machine Company, Cincinnati, Ohio, pointed out that in the Cincinnati area there is a concentration of diversified industry fundamental not only to the defense of the nation, but to the peacetime requirements of our people and second to none in the whole United States. Cincinnati is the center for soaps and shortenings; it is the machine-tool center of the nation and the world; it has become a very important chemical center not only for bulk basic chemicals, but for synthetic products, he said. Plastics, one of the newer divisions of the chemical industry, is represented in Cincinnati by the largest manufacturer of laminated products. Cincinnati is a tremendous industrial-alcohol center and probably makes more fatty acids than any place in the world. It has become the center for the manufacture and development of jet engines and atomic propulsion devices. It is a most important center for electronics of all types, radios, television sets and tubes, refrigerators, electrical equipment, steel, transportation, communication, and power generation. These industries, to mention but a few, in most instances require a variety of engineering skills and talents.

It is perfectly natural that men whose work interests and education and training are similar, should band together in their own technical organizations such as The American Society of Mechanical Engineers, American Society of Civil Engineers, American Institute of Electrical Engineers, and the like, he said. "In our area we have 23 chapters or sections of national technical societies and chapters of national organizations for the promotion of specific work interests. These organizations provide a source of continuing education and inspiration for the men who are associated with them and the companies in the area profit from the stimulation their men get from the many papers delivered and the associations formed in these groups."

Very early in the development of the technical-society movement, on April 18, 1888, a group of 11 engineers recognized the need for an organization in Cincinnati where men could get together as engineers—and not necessarily as mechanical engineers, electrical engineers, and the like.

The result was the organization of the Engineers Club—later The Engineering Society—which has continued uninterruptedly with varying degrees of influence up to the present time. As membership in the group grew from a dozen to several hundred, it became the nucleus of engineering life in this community. Because of the common interests, close relationships were maintained throughout the years with the local chapters of the national engineering societies. In 1935, Mr. Tangeman stated, nine local chapters of national societies banded together with the Engineering Society of Cincinnati, for the purpose of "bringing together the technical societies in the Cincinnati area for co-operative effort in rendering more and better service and furthering their scientific and technical activities." This meant that the participating local organizations would co-operate in arranging their programs so as to reduce conflicts, would encourage joint meetings of two of more organizations, and develop a publication as a coordinated means of announcing meetings to the entire membership. The Engineering

Society has always offered a forum for broad discussion not only of purely technical subjects but of civic and cultural problems which many people believe are outside the purview of the engineers.

Frank W. Willey, Mem. ASME, president, Willey Wray Electric Company, Cincinnati, Ohio, presided.

Calvin W. Rice Luncheon and Lecture

This year's Calvin W. Rice Lecture was presented at Wednesday's luncheon. The lecture on the "Past, Present, and Future of the Italian Power Industry," was to have been presented by Piero Ferrerio, chairman and president of the Italian Edison Company, Milan, Italy. However, Mr. Ferrerio was taken ill and the lecture was read by Giorgio Valerio, vice-president of the Italian Edison Company.

According to the lecture, the Italian power industry, which is almost exclusively hydroelectric, has reached the point where it can no longer rely upon water as its main source of energy and must, in the face of Italy's growing demand for power, base its future development upon a fuel for steam-power stations.

The recourse to steam power raises "delicate problems," however, it was pointed out. Italy is notoriously lacking in either coal or oil; an increased power output based on coal-fired stations would badly worsen the Italian currency balance. It is lucky that several natural-gas resources have been recently tapped in Italy, with favorable indications of future production.

The Rice Lecture is to be published in a forthcoming issue of MECHANICAL ENGINEERING.

Again, as in past years, the lecturer was elected a Life Member of the Society. Mr. Valerio accepted the membership certificate for Mr. Ferrerio.

Walker Cisler, Fellow ASME, president, The Detroit Edison Company, Detroit, Mich., made the introductions, and ASME president R. J. S. Pigott, presided.

Banquet

Speaking on the subject of "The Romance of Power and Fuels," at the Semi-Annual Meeting Banquet, on Wednesday evening, J. E. Tobey, Mem. ASME, president, Appalachian Coals, Inc., said that the spirit of adventure and the will to work is the catalyst which has led to the great discoveries and development of tools for the use of energy in America.

Mr. Tobey paid unstinted tribute to the sturdy character and great vision as revealed by the men who have sparked the development of tools and power, and the fuels as an indispensable corollary. By name he honored the careers of the men who have been associated with the development of the power industry, the engineers who have contributed to the development of steam-generating equipment, together with the firms who have led in these developments.

He also discussed the spectacular development of the electric-utility industry, pointing out that capacity has multiplied seven times in the past 25 years; and that present installed capacity of 81 million kw is expected to exceed 100 million kw by 1955.

Turning to the major fuel industries, Mr. Tobey traced the development and growth and relative position in today's complex industrial society. Noting the growth of oil and natural gas, Mr. Tobey pointed out that coal has not lost ground in tonnage, but has actually increased output over the past 50 years.

Mr. Tobey's address is scheduled for publication in an early issue of MECHANICAL ENGINEERING.

As part of the Banquet program, President Pigott presented to Edward A. Muller a certificate honoring him as a member of the Society for 62 years. Mr. Muller, who is president, treasurer, and general manager of the King Machine Tool Company in Cincinnati, is a Fellow of ASME. He was a manager of the Society from 1924 to 1927 and a vice-president from 1927 to 1929.

Mr. Pigott also presented H. L. Haworth, Mem. ASME, chief engineer, Fox Paper Company, Lockland, Ohio, with a certificate for his term as chairman of the Cincinnati Section during 1950 to 1951.

Management-Production Engineering Luncheon

Engineers were urged to equip themselves for their increasing role in management by supplementing their engineering ability with skill in dealing with people, by J. G. Pleasants, vice-president and director of manufacturing, Procter and Gamble Company, Cincinnati, Ohio, the principal speaker at the joint Management-Production Engineering Luncheon on Thursday.

He cited data which showed that engineers are entering management in greater numbers than ever before and said it was proper that they should because "the growing technical complexity of our civilization requires them. We literally can't get along without them and still maintain our present way of life."

The text of Mr. Pleasant's talk is scheduled for publication in MECHANICAL ENGINEERING.

T. A. Marshall, Jr., Mem. ASME, executive secretary, Engineering Manpower Commission of Engineers Joint Council, New York, N. Y., presided, while E. J. Martin, Mem. ASME, associate chief engineer, Procter and Gamble Company, Ivorydale, Cincinnati, Ohio, made the introductions.

Plant Trips

Four plant trips were scheduled during the meeting, all on Tuesday, June 17. ASME members and guests were given the opportunity to visit one of the following: Walter C. Beckjord Station of the Cincinnati Gas and Electric Company, General Electric Aircraft Gas Turbine Plant, Cincinnati Milling Machine Company, or the R.C.A. Tube Plant.

At the Beckjord Station, located 18 miles upstream from Cincinnati, members and guests inspected the newly installed 100,000-kw generating unit operating at 1450 psi, 1000 F throttle temperature with reheat to 1000 F. Unique features seen at the station included provisions to operate without interruption at an 83-ft river rise; and crane facilities to handle heavy equipment directly from river barges, since there is no direct railroad connection to the station.

The new-parts manufacturing facilities, engine assembly lines, and production-test cells at GE's new Gas Turbine Plant were visited by another group. Here, the visitors witnessed production J-47 turbojet engines undergoing operation tests.

A third group, visiting the Cincinnati Milling Machine Company, saw the company's main manufacturing plant, said to be the largest in the world, where both standard and special milling and grinding machines are made. They inspected the modern foundry where castings are produced on a jobbing basis; and the training school for apprentices, supervisory, and executive personnel. Also shown to the visitors were a new flame hardening process; a "Hydroforming process for metals; and the manufacture of "cimcool" fluids and precision-grinding wheels.

At the R.C.A. Tube Plant, the fourth group saw the manufacture of miniature-size vacuum tubes of the types used in radio, TV, and industrial electronic circuits. This included forming, assembly, and positioning of the internal parts; then evacuation, sealing, aging, and testing operations.

Women's Program

A well-planned program crammed with activity was arranged for the women in attendance at the meeting. The program started on Monday with a luncheon followed by an inspection trip to the Rookwood Pottery and Krohn Conservatory in Eden Park. On Tuesday morning the Women's Auxiliary held a business meeting. This was followed by luncheon and a card party at the Terrace Park Country Club. In the evening the ladies, accompanied by the men, visited Coney Island, Cincinnati's playground. Here, in the pleasant surroundings of Moonlight Gardens, the group enjoyed cocktails and a Southern fried chicken dinner. On Wednesday morning the ladies toured historic Taft Museum. In the afternoon they had luncheon at the Engineering Society of Cincinnati. A fashion show by the French Shop followed.

Committees

The committee in charge of arrangements for the Semi-Annual Meeting included the following: *General*, George H. Larkin, chairman; Darwin S. Brown, co-chairman; Raymond F. Schierland, secretary; *Finance*, Edward H. Mitsch, chairman; George A. Walther; *Hotel*, Robert W. Howorth, chairman; Edward J. Kuhn, and W. T. Saveland, Jr.; *Technical Events*, Mario E. Martellotti, chairman; Donald F. Baker, Fred F. Borries, Miles Connor, Robert M. Cundiff, M. E. Merchant, Robert Nelsen, E. J. Rivoira, William Taylor, and B. J. Yeager; *Reception*, Edward H. Schubert, chairman; D. S. Brown, C. A. Joerger, H. S. Malany, E. J. Martin, L. F. Nenninger, Fred Reiser, Jr., W. W. Tangeman, C. F. Roby, E. S. Sauerbrunn, and R. J. Short; *Entertainment*, John G. Martin, chairman; W. C. Bissmeyer, A. L. Jordan, W. M. Hickson, E. A. Kaiser, W. S. Kinney, H. B. Lammers, E. S. Sauerbrunn, and J. W. Thompson; *Plant Trips*, Harold B. Welge, chairman; William P. Clark, Arthur H. Evans, B. J. Yeager, and Henry M. Word; *Printing and Signs*, I. J. Rand, chairman; John F. Bartmess, and George A. Walther; *Information, Registration, and Service*, Edward J. Martin, chairman; Hugh B. Brandt, W. V. Chambers, Edmand S. Claxton, Robert S.

Hyatt, William S. Jordre, George F. Lockeman, Jack E. Wright, Richard J. Soike, Norman Stark, Norman S. Starks, and Henry Strobel, Jr.; *Publicity*, Alfred L. Kiewit, chairman; Paul H. Bluestein, James A. Carroll, Robert Nelsen, and Stanley E. Hess; *Women's Activities*, F. J. Simonitsch, chairman; Mrs. F. J. Simonitsch, co-chairman.

OGP Conference and Exhibit Attracts Large Audience

WITH its technical program keyed to design features of heavy-duty-Diesel, dual-fuel and gas engines, the 24th Annual ASME Oil and Gas Power Division Conference in Buffalo, N. Y., June 23–27, 1952, drew a record-breaking attendance and a word of praise from all. Registrations for the Conference totaled 405 men and 62 women.

It was apparent from the outset that the Buffalo Section had gone all out in handling local arrangements down to the last detail. Under the guidance of R. G. Tessmer, chairman, Buffalo Section, and H. W. Whiting, chairman, Arrangements Committee, assisted by C. M. Lowell, every phase of the Conference came off exactly on schedule, with ample evidence of careful planning and vigorous execution.

The technical papers were on an exceptionally high level as to content and delivery and discussions were unusually spirited. Since formation of the General Technical Committee some five years ago, this group representing all segments of interest in the internal-combustion power field, has steadily gained momentum. The meeting of this Committee at Buffalo was accorded the most interesting and helpful yet held.

Interspersing the technical sessions were social hours provided by the exhibitors, of whom there were some 36 concerns including engine and accessory manufacturers. Highlighting the social side of the conference was the welcome luncheon with a stirring talk by R. J. S. Pigott, President ASME, also the Annual Banquet with E. J. Schwanhouser, Worthington Corporation, as toastmaster and Rob Roy MacLeod, Niagara Mohawk Power Corporation, as principal speaker. The informal dinner at the General Brock Hotel, following inspection of the Schoellkopf Hydro-Electric Plant at Niagara Falls, was especially enjoyed by the entire body of men and women. Other inspection trips included the large Worthington Corporation plant in Buffalo, the Clark Brothers and Van der Horst Corporation plants in Olean, N. Y.

The program for the women provided daily activities of interest and entertainment.

VIEW OF THE OIL AND GAS POWER EXHIBIT

The outstanding success of this 24th Annual OGP Conference was a tribute to the outgoing chairman, Robert Cramer, Jr., Nordberg Manufacturing Co., and a challenge to the incoming chairman, K. W. Stinson, Ohio State University, who will steer the Division through its Silver Anniversary year.

G. W. FERGUSON HONORED AT OGP BANQUET

(The OGP Speakers Award was presented to Mr. Ferguson, Texas Company, New York, N. Y., at the OGP Banquet held June 25. *Left to right:* Mr. Ferguson, T. M. Robie, Fairbanks, Morse & Company; and Robert Cramer, Jr., Nordberg Manufacturing Company.)

ASME Calendar of Coming Events

Sept. 7–11
ASME Fall Meeting, Sheraton Hotel, Chicago, Ill.
(*Final date for submitting papers was May 1, 1952*)

Sept. 8–12
ASME Industrial Instruments and Regulators Division and Instrument Society of America Exhibit and Joint Conference, Cleveland Auditorium, Cleveland, Ohio
(*Final date for submitting papers was May 1, 1952*)

Sept. 22–24
ASME Petroleum Mechanical-Engineering Conference, Hotel President, Kansas City, Mo.
(*Final date for submitting papers was May 1, 1952*)

Oct. 30–31
ASME Fuels and AIME Coal Divisions Joint Conference, Bellevue-Stratford Hotel, Philadelphia, Pa.
(*Final date for submitting papers was June 1, 1952*)

Nov. 30–Dec. 5
ASME Annual Meeting, Statler Hotel, New York, N. Y.
(*Final date for submitting papers was July 1, 1952*)

April 28–30, 1953
ASME Spring Meeting, Deshler-Willick Hotel, Columbus, Ohio
(*Final date for submitting papers—Dec. 1, 1952*)

June 28–July 2, 1953
ASME Semi-Annual Meeting, Hotel Statler, Los Angeles, Calif.
(*Final date for submitting papers—Feb. 1, 1953*)

Oct. 5–7, 1953
ASME Fall Meeting, Hotel Sheraton, Rochester, N. Y.
(*Final date for submitting papers—July 1, 1953*)
(*For Meetings of Other Societies see page 697*)

Frederick S. Blackall, jr.
Nominated for President

ASME OFFICERS *Nominated for* 1952—1953

DURING the Semi-Annual Meeting of The American Society of Mechanical Engineers in Cincinnati, Ohio, June 15-19, 1952, Frederick Steele Blackall, jr., president-treasurer, The Taft-Peirce Manufacturing Company, Woonsocket, R. I., was nominated by the National Nominating Committee for the office of President of the Society for the year 1952-1953.

Regional Vice-Presidents named by the Committee to serve for two-year terms on the Council of the ASME were Henry Reginald Kessler, New York, N. Y.; Paul R. Yopp, Atlanta, Ga.; Ben George Elliott, Madison, Wis.; and Harry Randell Pearson, Dallas, Texas.

Directors at Large named by the Committee to serve a four-year term on the Council were David William Rowsen Morgan, Philadelphia, Pa., and Ralph Leon Goetzenberger, Washington, D. C.

Members of the Committee making the nominations were William P. Saunier, Boston, Mass., representing Region I; Kenneth J. Moser, Hoboken, N. J., representing Region II; Charles C. Di Ilio, State College, Pa., representing Region III; J. A. Keene, Birmingham, Ala., representing Region IV; C. R. Davis, Toronto, Can., representing Region V; Robert T. Mees, Peoria, Ill., representing Region VI; F. B. Lee, Seattle, Wash., representing Region VII; and Arnold R. Monisek, Dallas, Texas, representing Region VIII.

Election of ASME officers for 1952-1953 will be held by letter ballot for the entire membership, closing September 23, 1952.

Biographical sketches of the nominees follow on the succeeding pages.

Nominated for President

Frederick S. Blackall, jr.

FREDERICK STEELE BLACKALL, JR., who has been nominated to serve for one year as President of The American Society of Mechanical Engineers, has been since May, 1922, in the employ of the Taft-Peirce Manufacturing Company of Woonsocket, R. I., manufacturers of machinery and tools.

In 1929 he was made vice-president and general manager. He has been president and treasurer of the company since 1933. He was born in Roselle, N. J., Nov. 26, 1896, the son of Frederick Steele and Bertha (Brown) Blackall. He was graduated from Yale University in 1918 with a BA degree; also in 1918 he was graduated from the U. S. Naval Academy Third Reserve Officers' School; and in 1922 he received a BS degree from the Massachusetts Institute of Technology.

During World War I he served in U.S.N.R.F. and U.S.N. in the United States and overseas 1917–1918, with the rank of Ensign (T) U.S.N.

Since 1929, when Mr. Blackall became a member of ASME, he has served the Society as a member of the Executive Committee, Providence Section, later as chairman of the Section. He was a member of Standards committees on nomenclature, machine tapers (chairman), cylindrical fits, and was chairman of the 1946 Mission to England on A.B.C. Threads. He was a founder member in 1926 of the American Gage Design Committee. Since the inception of the committee he has been chairman of the Editorial Committee and a member of the Standing Committee. At one time he was chairman of the Technical Subcommittee. From 1945 to 1950 he was a Director at Large, member of the Executive Committee, and member of the Board on Codes and Standards, and in 1949–1950 he was chairman of the Board on Codes and Standards. In 1949 Mr. Blackall was made a Fellow ASME.

Mr. Blackall's vast interests in various commercial enterprises is underscored by his directorships in such organizations as the Federal Reserve Bank of Boston; The New York, New Haven & Hartford Railroad; and the New England Transportation Company. He is vice-president, director, and member of the Executive Committee of some six national and international businesses. He owns the Orchard House Farm at Cumberland Hill, R. I., commercial apple growers.

He has given of his time generously and is president of such professional associations as the National Machine Tool Builders Association and Woonsocket Hospital. He is a member of the Gage Industry Advisory Committee, U. S. Army Industrial College; and Machine Tools Advisory Committee, National Production Authority.

His membership in engineering societies includes ASM, ASTE, Providence (R.I.) Engineering Society, American Ordnance Association, Newcomen Society, Sigma Alpha Epsilon, and Theta Tau.

He is the past-president of the New England Council, 1944–1946, and former term member of the Corporation, M.I.T. (1946–1951).

He is the author of several articles published in magazines and newspapers, including technical and trade journals, on engineering, economic, and historical subjects. Also he is the author of the original text of the Report of the American Gage Design Committee, which was published by the U. S. Bureau of Standards, 1930, and he is editor of all subsequent editions.

Nominated for Regional Vice-President

To Serve Two-year Terms

H. R. KESSLER

P. R. YOPP

Henry R. Kessler

HENRY R. KESSLER, who has been renominated from Region II to serve for two years as Regional Vice-President of The American Society of Mechanical Engineers, was born in New York, N. Y.

He was graduated from Stevens Institute of Technology with a degree in mechanical engineering in 1921. After graduation he was employed in the operating department of the United Electric Light and Power Company (now the Consolidated Edison Company of New York) at the Sherman Creek and Hell Gate Power Stations. Several years later he joined the staff of Smoot Engineering Corporation, specializing in the field of automatic combustion control. After several years in the service department of the company, he became chief engineer of the Contract Division. In 1934 he became associated with Republic Flow Meters Company of Chicago when this company acquired the Smoot Engineering Company. At present he is manager of the Republic Flow Meters Company's New York office.

Mr. Kessler joined the Society in 1922 and is an active worker in the Metropolitan Section. In 1946 he served as treasurer of the Metropolitan Section and for the next two years he was chairman of the Section. Currently he is chairman of the Membership Committee of the Instruments and Regulators Division. He is also serving as vice-chairman of the Smoke Abatement Conference of the City of New York. He served in the Army during World War I.

Paul R. Yopp

PAUL R. YOPP, who has been nominated from Region IV to serve for two years as Regional Vice-President of The American Society of Mechanical Engineers, was born in Washington, Ga., June 1, 1891. He was graduated from Georgia Institute of Technology in 1916 with a BS degree in mechanical engineering.

In 1916–1917 he was a student engineer at the Dean Works of the Worthington Pump and Machinery Corporation, Holyoke, Mass. From 1917 to 1919 he was assistant inspector of engineering material for the Bureau of Steam Engineering, U. S. Navy, attached to the Hartford, Conn., office. Later he was in charge of the branch office at Waterbury, Conn.

He rejoined Worthington Pump and Machinery Corporation, Atlanta, Ga., as a sales engineer in 1919. Since 1920 he has been employed by The Babcock & Wilcox Company, Atlanta, Ga., first as a sales engineer and since 1926 as district sales manager.

Mr. Yopp became a junior member of the ASME in May, 1920, and a member in September, 1925. In 1944 he was chairman of the Atlanta Section and has served on such Section committees as the membership, finance, and student committees. He was a representative to the Regional Conference in 1945 and served on the National Nominating Committee in 1946 and 1948. He was an alternate member in 1947. He was chairman of Group Four of the Engineers Civic Responsibility Committee, in 1951–1952.

Mr. Yopp is a member of the Georgia Engineering Society, Newcomen Society, and several civic organizations. He is a registered engineer in Georgia.

Ben George Elliott

BEN GEORGE ELLIOTT, who has been nominated from Region VI to serve for two years as Regional Vice-President of The American So-

B. G. ELLIOTT

H. R. PEARSON

ciety of Mechanical Engineers, was born in North Platte, Neb., on Feb. 17, 1889. He was graduated from Rose Polytechnic Institute with a BS degree in 1910 and received his MS degree in 1911. In 1913 he received a mechanical-engineering degree from the University of Wisconsin.

Before his graduation from college, he was employed as a special apprentice in the locomotive shops of Union Pacific at North Platte. After graduation he was a special apprentice in the foundry and steam-turbine departments of Allis-Chalmers Company, in Milwaukee, Wis. He later worked as a special apprentice, machinist, and road man with McKeen Motor Car Division of Union Pacific.

From 1912–1913 he was a Fellow in mechanical engineering at the University of Wisconsin. Then he became an instructor in mechanical engineering in the University's Extension Division. In 1915 he joined the college of engineering of the University of Nebraska as associate professor of mechanical engineering. In 1917 he rejoined the staff of the University of Wisconsin's Extension Division as associate professor of mechanical engineering, and was put in charge of this department. During 1918 and 1919 he also served as a district representative of the Great Lakes District, Section on Education and Training, Emergency Fleet Corporation, U. S. Shipping Board. Since 1919 he has been professor and head of the mechanical-engineering department in the University of Wisconsin's Extension Division.

Professor Elliott became a junior member of the Society in 1911, an associate member in 1916 and a member in 1923. He is a life member of ASME. He has served as chairman of the Rock River Valley Section of ASME, as honorary chairman of the University of Wisconsin's student branch, and was the chairman of the Student Branch Committee for Region VI. In 1942 he was chairman of the Regional Meeting at St. Louis, Mo.

He is the author of three textbooks, "The Automobile Chassis," "Automobile Power Plants," and "Automobile Repairing," and is co-author of "The Gasoline Automobile." He has written many magazine and newspaper articles.

Professor Elliott is a member and past-national-director of the National Society of Professional Engineers and a member, and past-member of the Council, of the American Society for Engineering Education. He is also a member of the Engineers Society of Milwaukee, the National Association of Power Engineers, and the honorary engineering societies, Sigma Tau and Pi Tau Sigma.

Harry R. Pearson

HARRY RANDELL PEARSON, who has been nominated from Region VIII to serve for two years as Regional Vice-President of The American Society of Mechanical Engineers, was born in Taylor, Texas, Dec. 24, 1902. He received his engineering education at the University of Texas, Austin, Texas, where he received a BS degree in mechanical engineering in 1926.

After graduation he spent one year with Westinghouse Electric and Manufacturing Company at Philadelphia, Pa., as a student engineer in the Graduate Training Program. In 1927 he came to the Dallas Power & Light Company, Dallas, Texas, as a plant-betterment engineer with the responsibility of mechanical and electrical test work at the Dallas Steam Electric Station. He became head of operation at this station in 1933 with full responsibility of the operating forces.

In 1934 he was transferred to the engineering department and made responsible for engineering in connection with generating stations, substations, and transmission lines. One of the projects handled during this time was the design and construction of a generating station having one of the first installations utilizing outdoor-type boilers.

Mr. Pearson was given the responsibility for the development of an industrial relations program in the Company during 1944 and still heads up the department covering employee and labor relations.

Mr. Pearson has been a member of the Society since 1935 and has served in numerous capacities on a local, regional, and national basis. In the North Texas Section he has served as chairman, secretary, treasurer, and member of the Executive Committee. He was general chairman of the first Regional Meeting held in Region VIII and also served as chairman of the Committee on Student Branches. Prior to that time he was a member of the Standing Committee on Relations with Colleges.

He is a registered professional engineer, State of Texas, and member of the American Institute of Electrical Engineers, having served in a number of capacities in that organization. As a member of the Industrial Relations Committee of the Edison Electric Institute, he has been most active in their work.

Mr. Pearson is the author of numerous papers and articles of technological nature as well as those dealing with industrial relations.

Nominated for Directors at Large

To Serve Four-year Terms

D. W. R. MORGAN

R. L. GOETZENBERGER

David W. R. Morgan

DAVID WILLIAM ROWSEN MORGAN, who has been nominated to serve as Director at Large of The American Society of Mechanical Engineers for a four-year-term, was born in Martin's Ferry, Ohio, Sept. 16, 1892. He received his degree in mechanical engineering from Ohio Northern University in 1913.

He entered the employ of the Westinghouse Electric Corporation as a technical apprentice in 1913 and has remained with the company ever since. From 1917 to 1926 he was chief engineer of the Condenser Division in responsible charge of all engineering pertaining to surface, jet, and barometric-type condensers, on all types of centrifugal pumps. In addition from 1926 to 1940 he was put in direct charge of the design of the construction of high-speed

Diesel engines. In this period Mr. Morgan was the engineering head of the largest steam-condenser builder in the United States and, as the holder of 30 patents, was a leading figure in the development of heat-exchange equipment.

Since 1940 he has had principally management responsibilities for sales, engineering, and manufacturing. He became successively manager of manufacturing, steam division, manager of works, steam division, assistant division manager, division manager, and in 1946 he was made general manager of the South Philadelphia Works in charge of the entire operation. In this period he has had technical responsibility for the design of steam turbines ranging from small mechanical drives to 150,000-kva central-station power units and turbine geared propulsion plants for tankers, merchant vessels, and naval vessels from 50,000-hp destroyers to 212,000-hp battleships and aircraft carriers. This is the second largest activity of this type in the United States. Since 1948 he has been vice-president of the South Philadelphia Works.

Mr. Morgan joined the Society as an associate member in 1916, became a member in 1936, and was made a Fellow in 1949. He has served the Society as Vice-President and member of the Executive Committee (1943–1945); as chairman of the Board on Membership, 1951–1952; chairman, Admissions Committee, 1947; and on several other committees. He is now a member of the Engineers Civic Responsibility Committee and the Hoover Medal Board of Award.

He has received an honorary DE degree from Drexel Institute of Technology, 1950; and the Westinghouse Order of Merit, 1942. He is a member of the National Research Society, Sigma Xi, the Newcomen Society of England, and the Engineers Clubs of New York and Philadelphia.

R. L. Goetzenberger

RALPH LEON GOETZENBERGER, who has been nominated to serve as Director at Large of The American Society of Mechanical Engineers for a four-year term, was born in Minneapolis, Minn., Dec. 4, 1891. He attended the University of Minnesota and received a degree of BS in engineering in 1913 and EE in 1914. Upon graduation he joined the testing department of the General Electric Company in Schenectady, N. Y.

During and immediately after World War I he served as a major in the Ordnance Department, U. S. Army, in France, as chief of the design section, responsible for development and design of gunnery fire-control instruments for antiaircraft artillery. After working with various engineering firms as consultant, he was engaged by Minneapolis-Honeywell Regulator Company, Minneapolis, Minn., in 1927 to organize the industrial controls division. Under his direction, the company's first line of industrial control motors, valves, and the like was developed. After the acquisition of the Brown Instrument Company in 1935, Mr. Goetzenberger was made vice-president of the organization and had under his charge the market-research-development program, to further use of full-automatic controls in industry. He was responsible for and largely directed the efforts of the Moist-O-Graph and the use of instrumentation and automatic controls in the textile industry.

At the outbreak of the European war in 1939, he was detached from the Brown Instrument Company and given the assignment of directing the work covering contacts with the various divisions of the Armed Service, especially Army Ordnance and the Navy. Through Mr. Goetzenberger's efforts, the company played a prominent part in the fire-control instruments program. He was also active in committee work for the Army Ordnance Association in reference to the supply of optical glass.

Mr. Goetzenberger was made a vice-president of Minneapolis-Honeywell shortly before the outbreak of World War II and was put in charge of directing its efforts as well as that of its subsidiaries in developing and producing weapons required for the Armed Forces such as gun laying systems, electronic automatic pilots, and blind landing instruments. At present he is director of the company's Governments Projects Office in Washington, D.C.

Mr. Goetzenberger became a junior member of the Society in 1916, associate member in 1920, member in 1929, and was made a Fellow of the Society in 1949. He has been active in the Minneapolis, Philadelphia, and Washington, D. C. Sections. He assisted nationally in the organization of the Industrial Instruments and Regulators Section which is now a division of the Society. He has served as chairman of the ASME Education Committee and on several other committees of the Society. For six years he was ASME representative to the Engineers' Council for Professional Development.

He is a member of the EJC Committee of the U. S. National Commission for UNESCO, chairman of the government relations committee, Instruments Society of America, advisor to the U. S. Office of Education, and ECPD delegate on the Citizens Federal Committee for Education. Mr. Goetzenberger is a Fellow AIEE, and a member of several technical and scientific societies.

ASME 1953 Nominating Committee Organizes

SELECTED at the 1952 Semi-Annual Business Meeting of The American Society of Mechanical Engineers, Cincinnati, Ohio, June 15-19, 1952, the 1953 National Nominating Committee at its organization meeting chose A. R. Weigel, Consolidated Western Steel Corporation, 5700 S. Eastern Ave., Los Angeles 54, Calif., as chairman; and Karl P. Hanson, North Carolina State College, Raleigh, N. C., as secretary.

Plans were made for a preliminary meeting of the committee at the 1952 Annual Meeting, New York, N. Y., at which arrangements will be made as to time and location of the executive meeting for nomination of the Society Officers in 1953.

The 1953 National Nominating Committee is composed of the following:

Region I. Harry E. Harris, 229 Thorme Street, Bridgeport 6, Conn.; A. C. Crownfield, Jr., *1st Alternate*, Hart Manufacturing Company, 110 Bartholomew Ave., Hartford 1, Conn.; L. E. Seeley, *2nd Alternate*, College of Technology, University of New Hampshire, Durham, N. H.

Region II. William H. Bryne, Associates, Inc., 50 Broadway, New York 4, N. Y.; W. S. Johnston, *1st Alternate*, Sanderson & Porter, 52 William Street, New York 5, N. Y.; F. L. Bradley, *2nd Alternate*, Forstmann Woolen Company, 2 Barbour Ave., Passaic, N. J.

Region III. George M. Muschamp, c/o B. I. Division, Minneapolis-Honeywell Regulator Company, Wayne & Roberts Aves., Philadelphia 44, Pa.; J. William Putt, *1st Alternate*, Hahn Motors, Inc., Hamburg, Pa.; William N. Richards, *2nd Alternate*, International Correspondence Schools, 1001 Wyoming Ave., Scranton 9, Pa.

Region IV. Karl P. Hanson, *secretary*, North Carolina State College, Raleigh, N. C.; Roy C. Robertson, *1st Alternate*, University of Tennessee, Knoxville 16, Tenn.; E. M. Williams, *2nd Alternate*, Clinchfield Fuel Company, Box 410, Spartanburg, S. C.

Region V. W. A. Carter, Detroit Edison Company, 2000 Second Ave., Detroit 26, Mich.; E. W. Allardt, *1st Alternate*, Welded Tube Division, The Babcock & Wilcox Company, Alliance, Ohio; Ralph A. Sherman, *2nd Alternate*, Battelle Memorial Institute, 505 King Ave., Columbus 1, Ohio.

Region VI. R. S. Stover, R. S. Stover Company, 212 Kresge Building, Marshalltown, Iowa; Donald B. Naulin, *1st Alternate*, Diesel Division, Nordberg Manufacturing Company, 3073 S. Chase Ave., Milwaukee 7, Wis.; M. H. Linn, *2nd Alternate*, Deere & Company, Moline, Ill.

Region VII. A. R. Weigel, *chairman*, Consolidated Western Steel Corporation, Box 2015, 5700 S. Eastern Ave., Los Angeles 54, Calif.; S. T. Johnson, *1st Alternate*, American Smelting and Refining Company, Garfield, Utah; B. G. Dick, *2nd Alternate*, Department of Interior, Bonneville Power Administration, 1300 N. E. Union Ave., Portland, Ore.

Region VIII. R. P. Lockett, Jr., c/o A. M. Lockett & Company, 308 Whitney Building, New Orleans, La.; Carl A. Stevens, *1st Alternate*, Oklahoma Institute of Technology, Oklahoma Agricultural and Mechanical College, Stillwater, Okla.; R. B. Stewart, *2nd Alternate*, University of Colorado, Boulder, Colo.

People

1952 Academic Honors

ALBERT CAQUOT, president of the French National Academy of Science and past-president, ISO, and EDWIN H. LAND, president of the American Academy of Arts and Science and ASME Holley Medalist, 1948, received honorary degrees, DE and DS, respectively, at the Polytechnic Institute of Brooklyn commencement. CARLTON S. PROCTOR, president, ASCE, received a DE degree from Drexel Institute of Technology. Manhattan College awarded THOMAS E. MURRAY, Fellow ASME, a DS degree. E. G. BAILEY, Fellow and past-

president ASME, was presented with the Distinguished Service Award by the Ohio State University. W. H. STUEVE, Mem. ASME, was awarded a professional degree in ME by Oklahoma Institute of Technology. SANFORD L. CLUETT, Mem. ASME, and PIERO FERRERIO, of Milan, Italy, received DE degrees at the Rensselaer Polytechnic Institute commencement. HENRY T. HEALD, Mem. ASME, received an honorary degree from Rutgers University. At the Stevens Institute of Technology commencement among the leading engineers who were awarded honorary degrees were: RICHARD F. DRIMEL, Mem. ASME; FREDERICK A. MUSCHENHEIM, Mem. ASME; and THOMAS E. PURCELL, Fellow ASME. Among the graduating student members of the Society to be honored were: CLARISSE B. GEDULD, College of the City of New York; JAMES GORDON, RICHARD S. MENKEL, and DANIEL F. DE SANTO, New York University.

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THE RIGHT HONORABLE CLARENCE D. HOWE, Hon. Mem. ASME, Minister of Munitions and Supply, Canadian Government, Ottawa, Ont., Can., was elected as the fourteenth recipient of the Hoover Medal (1952). The award will be conferred on him on Sept. 10, 1952, during the Centennial of Engineering in Chicago, Ill.

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STEPHEN D. BECHTEL, outstanding engineer, businessman, and international builder, was selected as the "Alumnus of the Year" for 1951, by California Alumni Association, University of California, Berkeley, Calif.

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PRINCE LOUIS DE BROGLIE, French scientist, and a former Nobel prize winner, was awarded the annual Kalinga international prize of 1000 pounds sterling for the best work in the field of popularization of science in a ceremony at Paris Headquarters of the United Nations Educational, Scientific, and Cultural Organization.

The ceremony took place in the presence of M. B. Patnaik, an Indian industrialist who established the award last year under the auspices of UNESCO as a means of focusing attention on the need for greater understanding and broader use of science for human welfare.

Prince de Broglie, the first recipient of the prize, is internationally famous both for research in theoretical physics and for pioneer achievements in the popularization of science. He is the honorary president of the French Association of Science Writers and the permanent secretary of the French Academy of Science.

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LAWRENCE A. APPLEY, Assoc. ASME, was re-elected president of the American Management Association for the fifth year. ELMER L. LINDSETH, Mem. ASME, president, Cleveland (Ohio) Electric Illuminating Company was among those elected as director of the association for a three-year term.

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J. M. LESSELLS, Mem. ASME, associate professor, mechanical engineering, Massachusetts Institute of Technology, Cambridge, Mass., and STEPHEN P. TIMOSHENKO, Fellow ASME, professor, theoretical and applied mechanics, Stanford University, Stanford, Calif., were recently elected Honorary Members of The American Society of Mechanical Engineers.

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HENRY R. KESSLER, Mem. ASME, Manager, Republic Flow Meters Company, New York, N. Y., has been designated as an Honorary Vice-President to represent The American Society of Mechanical Engineers at the Fourth International Congress of Industrial Heat and Applied Thermodynamics, to be held in Paris, France, Sept. 27 to Oct. 4, 1952.

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FRANK H. PROUTY, Fellow ASME, Prouty Brothers Engineering Company, Denver, Colo., has been appointed a representative of The American Society of Mechanical Engineers at the annual meeting of the National Council of State Boards of Engineering Examiners, at Colorado Springs, Colo., Sept. 4–6, 1952.

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THOMAS J. DOLAN, Mem. ASME, research professor, theoretical and applied mechanics, University of Illinois, received the Richard L. Templin Award, and J. J. KANTER, Mem. ASME, directing engineer, Engineering Laboratories, Crane Company, Chicago, Ill., was among the recipients of the 1952 ASTM Awards of Merit, at the society's fiftieth annual meeting held in New York, N. Y., June 23–27.

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WILLIAM F. GIBBS, Fellow ASME, president, Gibbs and Cox, Inc., is the designer of the new luxury liner *United States*, which on her maiden voyage broke all records for a Trans-Atlantic crossing.

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S. C. HOLLISTER, Mem. ASME, dean of the Cornell University college of engineering, received the Lamme Medal of the American Society for Engineering Education, which held its sixtieth annual meeting at Dartmouth College, June 23, 1952. ARTHUR L. WILLISTON, Mem. ASME, retired principal of Wentworth Institute, was also honored. He received the James H. McGraw Award. ASEE Mechanical-Engineering Division officers elected were: I. W. SMITH, secretary; HERBERT KUHNZEL, ASEE councilman; and NEWMAN A. HALL, secretary, Heat-Power Subdivision, all ASME members.

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EVERETT M. STRONG, supervisor of the Engineering Industrial Co-operative, and professor of electrical engineering, Cornell University, was elected as president of the Illuminating Engineering Society.

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LEWIS W. JONES was inaugurated as the fifteenth president of Rutgers University on May 8, 1952. H. R. KESSLER, vice-president, Region II, represented ASME.

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HILDING V. TÖRNEBOHM, vice-president and technical director of SKF Industries, Göteborg, Sweden, was elected president of the International Organization for Standardization (ISO) on June 21, 1952. He succeeds Dr. A. Caquot, French engineer, who ends his three-year term on Dec. 31, 1952.

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DAVID B. STEINMAN, New York, N. Y., builder of bridges on five continents, has received the second award ever given by the National Society of Professional Engineers for distinguished service to the engineering profession. The presentation was made on May 7, 1952, at the Society's 18th annual meeting in Tulsa, Okla.

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HERBERT F. ROHMOHL, Mem. ASME, professor of mechanical engineering and dean of students, Cooper Union's school of engineering, was installed on June 6, 1952, as president of the New York Chapter of the New York State Society of Professional Engineers at their annual meeting at the Hotel Statler, New York, N. Y.

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SEWELL H. DOWNS, Mem. ASME, vice-president and chief engineer, Clarage Fan Company, Kalamazoo, Mich., has been elected as president of the Michigan Engineering Society for 1952–1953.

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MOREHEAD PATTERSON, Mem. ASME, chairman of the board of directors and president of American Machine & Foundry Company has been re-elected as vice-president of the Machinery & Allied Products Institute.

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L. C. CAMPBELL of Pittsburgh, Pa., was elected as president of the National Coal Association, Washington, D. C., at a recent meeting of the board of directors and TOM PICKETT, presently a member of Congress from Texas, to the post of executive vice-president.

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JOHN W. MARDEN, Westinghouse Lamp Division research scientist, recently received the highest civilian award given by the Department of the Army—The Certificate of Appreciation.

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F. R. WHITE, chief engineer for the Iowa Highway Commission, was honored at commencement exercises at Iowa State College June 13, 1952, when he was awarded the Marston Medal for achievement in engineering.

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JOHN J. AHERN, director, department of fire protection and safety engineering, Illinois Institute of Technology, Chicago, Ill., was elected president of the Society of Fire Protection Engineers at the annual meeting on June 12, 1952, at the Hotel Statler in New York.

Among the other officers elected was first vice-president, John A. Neale, Mem. ASME, chief engineer, National Board of Fire Underwriters, New York, N. Y.

ASTM 50th Anniversary Meeting Stresses Importance of Standards and Research in Materials

AT the 50th Anniversary Meeting of the American Society for Testing Materials held in New York, N. Y., during the week of June 22, there were presented 165 papers in some 40 formal and informal technical sessions and 70 reports from the technical committees. The unusually strong technical program arranged to commemorate the Society's formal incorporation as a national technical society in 1902, together with the 450 technical-committee meetings and the Society's largest exhibit of testing apparatus and scientific instruments, attracted a record-breaking number of engineers and materials men totaling 2606.

New Specifications Approved

As a result of recommendations in the some 70 committee reports at the meeting, 75 new specifications and tests were approved for publication for the first time. Most of the committees have concentrated during the first half of this year on revising their standards so that they would be up to date for the new 1952 edition of the big book of ASTM Standards to be issued later this year, and in reviewing tentatives to be adopted as final standards. Some 90 existing tentatives were recommended for adoption as formal standards subject to Society letter ballot. Also there are about 270 standards and tentatives in which revisions are to be incorporated.

About 150 American and Canadian technical and scientific societies, trade associations, and related groups, branches of the Federal Government, and many from across the seas had designated delegates to represent them officially at this Fiftieth Anniversary Meeting of ASTM. These groups were recognized through a program at the President's Luncheon at which it was pointed out that since the Society was founded life had changed from a simple one to be highly complex. The remarkable spurt in industrialization brought into play many new forces and activities. Our list of products has been enlarged and diversified almost beyond measure. Numerous raw materials, unknown or unused in earlier years, daily flow through hundreds of processes of manufacture. The increasing adoption of the scientific approach to the problems of industry, has injected degrees of refinement and exactness which prescribe reliance upon carefully determined chemical and physical properties. In many aspects of dealings between and among producers and consumers, ASTM had meant the difference between order and chaos.

Technical Program

Of the some 40 technical sessions at the meeting, 23 comprised technical symposiums on timely materials subjects. The balance were devoted to groups of papers on specific subjects or were report sessions or round tables.

Several of the symposiums were designed to provide an over-all review of significant technical problems, analyze the current status, and provide a "look ahead." They covered the following subjects: Effects of notches and metallurgical changes on strength and ductility of metals at elevated temperatures, tin, insulating oil, continuous analysis of industrial water and industrial waste water, conditioning and weathering, application of the electron microscope to metallurgy, light microscopy, determination of elastic constants, fretting corrosion, nondestructive testing, testing adhesives for durability and permanence, textiles, plastics testing—present and future, direct shear testing of soils, recent developments in the evaluation of natural rubber, exchange phenomena in soils, and test methods for process control in ceramic whitewares.

Other groups of papers concerned such subjects as fatigue, including the statistical approach; paint (major accomplishments in the several fields); nonferrous metals; durability of concrete; cement and concrete; and corrosion and creep of metals.

The Marburg and Gillett Lectures were also presented during the meeting.

UPADI Announces Panel for New Orleans Convention

THE afternoon meeting of Aug. 29, 1952, at the third UPADI (Pan-American Federation of Engineering Societies) Convention which will be held Aug. 25-30, New Orleans, La., will provide an international panel discussion on the subject—"Engineering Aspects of the Economic and Financial Development of Latin America." It is planned that seven speakers shall each discuss the subject for 15 minutes from the particular point of view of his own country.

The addresses will be in the speaker's native language, with simultaneous translation through an earphone system for the benefit of those otherwise unable to understand. Only the exigencies of advanced planning of time confine the participants to the selected countries and it is hoped that there may develop an opportunity for remarks and questions from the floor.

The subject is an important one. It relates to the fundamental objectives of UPADI as set up in the proposed Constitution. The speakers will be eminent representatives of the engineering organizations of the Western Hemisphere. Argentina will be represented by J. Allende Posse; Brazil by F. Saturnino de Brito filho; the United States by Ross W. Davidson; and Uruguay by Luis Giorgi. The names of speakers from Chile, Mexico, and Venezuela are not presently available but they are expected to participate.

Industrial Metallurgical Research at SRI

INCREASED demand for industrial scientific research in the field of metallurgy has brought about the establishment of a department of metallurgy at Southwest Research Institute, Dr. Harold A. Vagtborg, Mem. ASME, president, has announced.

The department is undertaking industrial metallurgical research in foundry practice, process metallurgy, and physical metallurgy in addition to studies in metal economics.

ASME Membership as of June 30, 1952

Honorary Members	54
Fellows	369
Members	13,285
Associates	356
Juniors (33 and over)	3,268
Juniors (30-32)	1,887
Juniors (to the age of 29)	17,043
Total	36,262

ASME Applied Mechanics Division Holds Second Western Meeting

UNIVERSITY of California, Los Angeles, was host on June 26-28, 1952, to the Second Western Conference of the Applied Mechanics Division of The American Society of Mechanical Engineers. Seventy-four registrants attended one or more of the five sessions to hear the 16 papers presented.

Papers presented included vibrations, nonlinear dynamics, plates, plasticity, creep properties of materials, elasticity, and design. Authors from the Western states and other sections of the country participated. Lively discussions from the floor indicated keen interests in the subject matter presented.

The general intention of the Western meeting is to bring its facilities to those in the West who wish to participate in the field of applied mechanics but are unable to travel to the Eastern meetings.

The Executive Committee of the Division has ruled that papers can be presented at both meetings if the authors so desire, and the programs permit. Papers of both meetings will normally be published in the *Journal of Applied Mechanics* and preprints made available prior to the presentation.

The third West Coast Meeting of the Applied Mechanics Division will be held in conjunction with the Semi-Annual Meeting of the ASME to be held in Los Angeles in June, 1953, for which authors are invited to submit papers. Papers should be sent to the National Secretary, Professor Dana Young, University of Minnesota, Minneapolis, Minn.

For further information regarding this meeting write to Robert Bromberg, Secretary of the West Coast Committee of ASME Applied Mechanics Division, Engineering Department, U.C.L.A., Los Angeles 24, Calif.

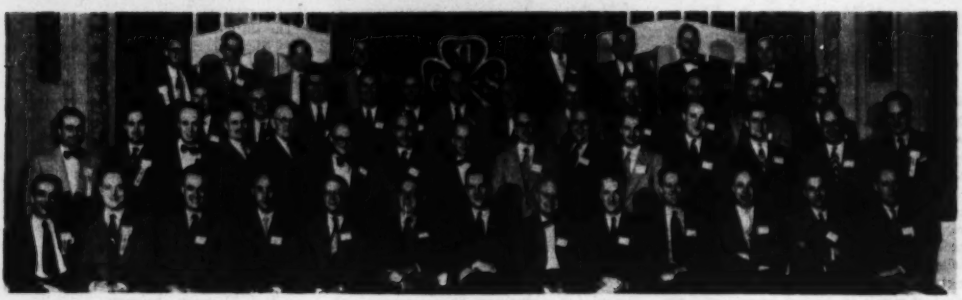
The U.C.L.A. meeting this year was arranged by Robert Bromberg, M. S. Plesset, and and W. T. Thomson, chairman.

ASME Regional Administrative Committees Hold Meetings During March and April

REGION I, BRIDGEPORT, CONN.

REGION II, NEW YORK, N. Y.

REGION III, CORNING, N. Y.



REGION VI, DAVENPORT, IOWA

Region IV, Raleigh, N. C.

Region VII, Seattle, Wash.

Region VIII, Denver, Colo.

Society Affairs Discussed by 1952 ASME Regional Delegates at Cincinnati, June 15–16

RECOMMENDATIONS of the ASME Regional Delegates Conference, which met at the Sheraton-Gibson Hotel, Cincinnati, Ohio, on June 15 and 16 during the 1952 ASME Semi-Annual Meeting, were reported to the Council at the conclusion of the conference and have been passed on to appropriate ASME committees for study and suggested action. After the committees have completed their studies and have reported on them, the Council will take appropriate action and prepare a report of the final disposition of every recommendation.

Through the Regional Delegates Conference, members of ASME have an opportunity to discuss Society affairs and have a voice in procedures which bring matters of importance to them to the attention of the Council in an orderly manner. Each conference elects an Agenda Committee whose duty it is to assemble from members and sections subjects and suggestions on which action is desired. These agenda items are discussed and acted upon at meetings of the eight Regional Administrative Committees, held in the Spring, consisting of representatives of sections of each Region. Each Region sends two delegates, a senior and a junior delegate, to the conference held at the time of the Semi-Annual Meeting. Here the agenda items are discussed by the delegates and the final recommendations are prepared for submission to the Council.

The speaker of the 1952 conference, C. C. Womack, was unable to attend because of the steel strike, and the delegates elected the vice-speaker, S. T. Johnson, to fill his place. A. T. Kniffen was elected vice-speaker. The secretary of the 1952 conference was B. B. Brainard. The Regional Delegates who attended the conference were as follows (the first name given in each case is that of the senior delegate and the second, that of the junior delegate, except where noted):

Region I: Philip A. Nims and Robert S. Harper

Region II: A. T. Kniffen and Edward S. Rowell

Region III: Edwin P. Nye and Raymond G. Tessmer

Region IV: Parker S. Capps and Alex C. Ormond

Region V: J. C. Jefferds, Jr., and C. A. Meyer (junior delegate and first alternate, respectively)

Region VI: Donald B. Naulin and Robert W. Mills

Region VII: S. T. Johnson and Robert E. Wiegand (senior delegate and first alternate, respectively)

Region VIII: B. B. Brainard and Glyn W. Beesley.

The 1952 Agenda Committee consisted of Edward H. Walton, chairman, and William H. Byrne.

Officers for the 1953 Regional Delegates Conference were elected as follows: Speaker, J. C.

REGION V, DAYTON, OHIO

Jefferds, Jr., Region V; vice-speaker, G. W. Beesley, Region VIII; secretary, R. S. Harper, Region I; member of Agenda Committee, C. C. Womack, Region V. The Nominating Committee consisted of A. T. Kniffen, chairman, P. A. Nims, and D. B. Naulin. Resolutions of thanks and appreciation, unanimously approved, were prepared by a committee consisting of R. G. Tessmer, chairman, Alex C. Ormond, and J. C. Jefferds, Jr.

ASEE Annual Meeting Emphasizes Importance of Human Being

Dartmouth College, Hanover, N. H., June 23–27

THE importance of the human being was reaffirmed at the sixtieth annual meeting of the American Society for Engineering Education held at Dartmouth College, Hanover, N. H., from June 23–27, 1952.

Underlying all the talks and discussions of engineering and education was the basic recognition that an understanding of the way people feel and act and dream was even more important than an understanding of the inner workings of the atom.

Dr. C. C. Furnas, Mem. ASME, director of Cornell Aeronautical Laboratory, gave knowledge last place in a list of qualities of successful engineers in a speech before the annual banquet of the Society. Ahead of knowledge Dr. Furnas placed "drive," "imagination," "judgment," and "facility in human relations." The mind also came out last in another Furnas-prepared list where "economic advantage" and "snobbishness" were placed ahead of "intellectual curiosity."

Even in the establishment of technical criteria the human element was stressed. Prof. George R. Town, associate director of Research at Iowa State University, stated that "the judgment of the eye of the observer rather than the reading of a dial should be the ultimate judge of picture quality in television." In the same vein Lillian Gilbreth, Hon. Mem. ASME, told industrial engineers that they should devote their efforts to making the factory, the mine, the office, the store, the school, and the home places where people do more at less cost in motion, in energy, in time.

The popular belief that manpower for the professions in the United States is inexhaustible is far from true, Dean S. C. Hollister, Mem. ASME, of Cornell University warned in his presidential address. He pointed out that studies and tests have revealed that only 120,000 youths are available annually who possess the intelligence and ability for professional training for medicine, science, law, theology, engineering, and the upper levels of the teaching profession.

Current freshmen enrollment of 38,000 in engineering represents just about the maximum of engineering's share of this annual pool of qualified young men, Dean Hollister stated. "If by artificial stimulation a larger number are persuaded to enter engineering schools it will probably be at the expense of enrollments in other learned fields."

To answer the problem created by a limit in engineering manpower on the one hand and a steadily increasing need for engineering services on the other, Dean Hollister urged the training of more aides to support engineers, as in the case of medicine, and a change in industry's policy of using college-trained engineers for junior administrative work and related activities.

To these two factors which need to be considered in the readjustment of the engineering profession to the needs of today's economic system, Dean Hollister added a third. "It appears that we have reached a turning point in the profession," he said, "where it appears that a complete reorganization must take place over the next few years if the engineering of the future is to be achieved at the level demanded by our economic system."

Dean Hollister urged a revision of the teaching of engineering that would do away with routine, pedestrian, mind-dulling methods of instruction. "Engineers should be taught from the first day that in actual practice there is no one right answer to a problem in creative design, rather there are many good and satisfactory answers. The problem method which is now widely used and which is based upon the premise that there is only one correct answer kills initiative and imagination."

In other talks, Professor Carl Muhlenbruch of Northwestern University urged his colleagues to place more stress on real pioneering by granting engineers greater freedom in their methods used to deliver the goods and in ex-

WILLIS R. WOOLRICH, DEAN, UNIVERSITY OF TEXAS, NEWLY ELECTED PRESIDENT OF THE AMERICAN SOCIETY FOR ENGINEERING EDUCATION IS CONGRATULATED BY THE SOCIETY'S RETIRING PRESIDENT, DEAN S. C. HOLLISTER OF CORNELL UNIVERSITY, *right*

panding their horizons; John D. Leigh, associate dean of Lehigh University, called upon teachers of English to evaluate the freshman engineering student as a human person who needs to be given the opportunity to be creative; Pemberton Johnson of Educational Testing Service said that we need tests of a man's scale of values—what importance he puts on working with other people, working with things, working with ideas, and living as a free person under a representative form of government; and Director William C. Krathwohl of Illinois Tech's Institute for Psychological Services told engineering teachers that they would gain by using color to make lessons clear and interesting.

Attention to human and moral values, stressed by President Hollister and a host of other speakers at the meetings, was the theme of Dartmouth's President John Sloan Dickey in his remarks to the educators. "We may be turning a right-angle corner," he said, in discussing the role of higher education. "To have a sense of purpose, the college has to serve human society by furnishing men with a balance between utter physical power and the political control of that power. This balance is the moral sense of man and his will and capacity to serve for the human good."

Meetings of Other Societies

Aug. 20-28
Eighth International Congress for Applied Mechanics, Istanbul, Turkey

Aug. 25-30
Pan-American Federation of Engineering Societies (UPADI), St. Charles Hotel and Tulane University, New Orleans, La.

Aug. 25-Sept. 1
Fourth Congress of the International Association for Bridge and Structural Engineering, Cambridge and London, England

Aug. 25-Sept. 2
International Union of Theoretical and Applied Mechanics, second general assembly, Istanbul, Turkey

Sept. 3-13
Centennial of Engineering, Chicago, Ill.

Sept. 4-6
National Council of State Boards of Engineering Examiners, 31st annual meeting, The Antlers Hotel, Colorado Springs, Colo.

Sept. 8-10
American Standards Association, third national standardization conference, Museum of Science and Industry, Chicago, Ill.

Sept. 8-11
Society of Automotive Engineers, national tractor meeting and production forum, Hotel Schroeder, Milwaukee, Wis.

Sept. 9-13
The American Chemical Society, seventh national chemical exposition, Chicago Coliseum, Chicago, Ill.

Sept. 10-12
Engineering Institute of Canada, maritime professional meeting, Algonquin Hotel, St. Andrews-by-the-Sea, N. B.

Sept. 10-12
National Petroleum Association, 50th annual meeting, The Traymore, Atlantic City, N. J.

Sept. 22-25
The Royal Swedish Academy of Engineering Sciences (IVA) and the Association of Technical Physicists (TFF), instruments and measurements conference, Stockholm, Sweden

(*ASME Calendar of Coming Events see page 687*)

Metals Processing Laboratory Dedicated at M.I.T.

Gift of Alfred P. Sloan Foundation, Inc.

DEDICATION exercises for the new Metals Processing Laboratory at the Massachusetts Institute of Technology were held June 3, 1952, in the presence of a distinguished group of scientists, industrialists, and educators. The new building, provided by a gift of $1,000,000 from the Alfred P. Sloan Foundation, Inc., marks a step of significant progress in education and research in all types of metal forming and machine-tool work.

The new building provides the first adequate housing for M.I.T.'s comprehensive metal-processing program which was inaugurated in 1946. The program is administered jointly by the departments of metallurgy and mechanical engineering.

The Metals Processing Laboratory was created as an interdepartmental laboratory to bring the application of both metallurgical science and of engineering design to the basic crafts of machining, finishing, casting, forging, welding, and related techniques of modern manufacturing. By providing students with an awareness of the technical phases of metal production, the program also helps engineers to cope with many of the human problems of modern production.

The Metals Processing Laboratory is located on the main M.I.T. campus and incorporates the latest construction ideas, newest scientific apparatus, and furnishings.

The ground and first floors and part of the second are devoted to instruction and research in machine-tool operations, with particular emphasis on metal-cutting studies. The remaining part of the second and all of the third floor are devoted to metalworking and powder-metallurgy equipment. The fourth floor contains a well-equipped foundry and welding laboratory. Recitation rooms are located throughout the building with two amphitheater-type lecture halls on the second floor.

A unique feature of the new building is a penthouse "commons room" above the fourth floor for the use of all students and faculty members. Equipped with complete kitchen facilities, this room is designed to stimulate social contacts between faculty and students.

The top-floor location of the foundry, immediately under the penthouse, simplifies ventilation problems, since only short stacks are needed to bring waste gases through the roof. Elsewhere in the building, mechanical ventilation is used.

Fulbright Awards

FULBRIGHT Awards, 1952–1953, for university lecturing and advanced research in Europe, Africa, and the Near and Far East are available for graduate students who wish to pursue studies abroad on the predoctoral level. Applications must be postmarked no later than Oct. 15, 1952. For application forms and additional information write to Conference Board of Associated Research Council's Committee on International Exchange of Persons, 2101 Constitution Avenue, Washington 25, D. C.

Actions of the ASME Council at a Meeting Held in Cincinnati, Ohio, June 15–16, 1952

FOUR sessions of the Council of The American Society of Mechanical Engineers were held at the Sheraton-Gibson Hotel, Cincinnati, Ohio, on June 15 and 16 during the 1952 ASME Semi-Annual Meeting. President Pigott presided, and all members of the Council except Ralph A. Sherman, who was abroad, were present at some or all of the sessions.

Finances

It was reported that the B Development Fund, as of the date of the meeting, amounts to $100,972.50.

The estimates of income and expenditures for the fiscal year Oct. 1, 1952, to Sept. 30, 1953, which will appear in the September issue of MECHANICAL ENGINEERING.

Amendments to By-Laws

Approval was voted of the adoption of Par. 18-c, By-Law B6A, presented for first reading on Nov. 25-26, 1951, which provides for a National Junior Committee, under the direction of the Board on Education and Professional Status, which "shall have as its objectives the development and implementation of policies and procedures directed toward the professional development of young engineers and the encouragement of Junior members to participate in the affairs of the Society," and sets forth how the membership of the committee shall be constituted.

Approval was also voted of a change of Article R8 Rule 1 to read "The office of the Secretary shall be open on Monday through Friday from 9:00 a.m. to 5:00 p.m."

An amendment to Article B6A, Par. 12, was received for first reading. The amendment refers to the Organization Committee and provides for the possibility of substituting past vice-presidents or former members of the Council in the place of past-presidents as members of the committee.

Action on proposed amendments designed to put into effect changes in membership grades as suggested by ECPD for the purpose of uniformity in grade designations in the engineering societies was withheld pending further review.

Honors and Awards

On recommendation of the Board on Honors, J. M. Lessells, Cambridge, Mass., and Stephen P. Timoshenko, Stanford, Calif., were elected to Honorary Membership.

Approval was voted of the following awards and honors for 1952:

ASME Medal, to Nevin E. Funk, Fellow ASME, consulting engineer, Philadelphia, Pa.

Holley Medal, to Sanford L. Cluett, Mem. ASME, vice-president, Cluett, Peabody and Company, Inc., Troy, N. Y.

Worcester Reed Warner Medal, to Max Jakob, Mem. ASME, research professor of mechanical engineering, Illinois Institute of Technology and Armour Research Foundation, Chicago, Ill.

Melville Medal, to Neil P. Bailey, Fellow ASME, head, mechanical-engineering department, Rensselaer Polytechnic Institute, Troy, N. Y., for his paper, "Flow and Combustion Stability."

Junior Award, to Warren M. Rohsenow, Jun. ASME, associate professor of mechanical engineering, Massachusetts Institute of Technology, Cambridge, Mass., for his paper, "A Method of Correlating Heat-Transfer Data for Surface-Boiling of Liquids."

Richards Memorial Award, to Jess H. Davis, Mem. ASME, president, Stevens Institute of Technology, Hoboken, N. J., "for outstanding achievement in mechanical engineering within 20 to 25 years after graduation."

Pi Tau Sigma Gold Medal Award, to Hubbert L. O'Brien, Mem. ASME, assistant manager of research, Graver Tank and Manufacturing Company, East Chicago, Ill., "for outstanding achievement in mechanical engineering within 10 years after graduation."

Coming Meetings

Approval of the Board on Technology of the following national meetings in 1953 was noted:

Spring Meeting, Columbus, Ohio, April 28–30, Deshler-Wallick Hotel.

Semi-Annual Meeting, Los Angeles, Calif., June 28–July 2, Statler Hotel.

Annual Meeting, New York, N. Y., Nov. 29–Dec. 4, Statler Hotel.

Textile Engineering Division

Approval was voted of a change of name of the ASME Textile Division to Textile Engineering Division.

Standardization

Chairman Graves of the Board on Codes and Standards reported that during the week of June 2 important meetings were held in New York of representatives of Great Britain, Canada, and the United States which resulted in additional progress in securing agreement among the three countries on screw threads drafting-room practice, and related standards. He also reported that during the two weeks commencing June 9, in New York City, representatives of 26 countries attended meetings of the International Standards Organization.

Mr. Graves' observations of both meetings led to his conclusion that more adequate American standards representation must be provided in order properly to keep American standard activities and accomplishments before the standardization bodies of the rest of the industrial world. He pointed out that this would require additional funds to assure representation of American-standards activities which he believed might be secured from industry.

Mr. Graves read letters from John R. Steelman, acting director of Defense Production, and George F. Hussey, director of American Standards Association, expressing appreciation of the part played by the ASME members and staff in the conduct of the two standardization meetings.

Research

The report of the Special Research Review Committee was accepted in principle and referred to the Board on Technology.

Sections

The Plainfield (N. J.) Section was transferred from Region III to Region II for a trial period of two years.

Authorization was voted of Section status for the San Diego Subsection of the Southern California Section.

It was decided to prepare a suitable form of charter to be awarded to new Sections and Subsections by the vice-presidents.

1952 Regional Delegates Conference

The Council expressed thanks and appreciation to the Regional Delegates for their work and referred the recommendations of the 1952 Regional Delegates Conference to the committees concerned for report.

Certificates of Award

Certificates of award were authorized to each member of the 1952 Agenda Committee of the Regional Delegates Conference "for meritorious service to the Society in preparing the compilation of agenda index and actions"; and to the following chairmen and past-chairmen of Sections: A. M. Deiters (Atlanta), Robert G. Critz (Mid-Continent), Clarence E. McCormick (Youngstown), John P. Newmann (Fairfield County, 1949–1951), Nicholas A. Welch (Hartford, 1950–1951), A. L. Thurman, Charles C. Womack, and William J. Langacher (Youngstown, 1948–1949, 1949–1950, and 1950–1951, respectively), and S. T. Johnson (Utah).

Unity

The Council took certain actions on the recommendations of Engineers Joint Council (see MECHANICAL ENGINEERING, July, 1952, pages 616 and 617) relating to proposals to enlarge EJC as a first step in providing for a "unity" organization. In effect, these actions authorized the President and Secretary to approve for the Society modifications of the EJC constitution and included the suggestion that invitations be sent by EJC to certain non-EJC societies that were represented on the Exploratory Group (American Association of Engineers, American Society of Engineering Education, American Society of Heating and Ventilating Engineers, American Water Works Association, Institute of the Aeronautical Sciences, Institute of Radio Engineers, National Society of Professional Engineers, and the Society of Naval Architects and Marine Engineers) for the enlargement of EJC.

World Power Conference

The ASME Council approved in principle the action of Engineers Joint Council, on May 16, 1952, by which EJC accepted the secretariat of the U. S. National Committee for the World Power Conference.

Dartmouth Newcomen Association

The Secretary reported that a Dartmouth (England) Newcomen Association is being formed "to foster the memory of Thomas Newcomen." The ASME Council directed the Secretary to send a message of greeting to the Association on the occasion of its meeting on Aug. 16, 1952, and arrange for suitable recognition to be made at the Newcomen monument.

1952 Calvin W. Rice Lecturer

A message of appreciation with best wishes for his early recovery was sent to Dr. Piero Ferrerio of Milan, Italy, 1952, Calvin W. Rice Lecturer, who was unable to deliver the lecture because of illness.

James L. Walsh

The Council noted with deep regret the death of Col. James L. Walsh, Mem. ASME, on June 13, 1952.

ASME Standards Workshop

Interpretations of Code for Pressure Piping

FROM time to time certain actions of the Sectional Committee B31 will be published for the information of interested parties. While these do not constitute formal revision of the Code, they may be utilized in specifications, or otherwise, as representing the considered opinion of the Committee.

Pending revision of the Code for Pressure Piping, ASA B31.1–1951, the Sectional Committee has recommended that ASME, as sponsor, publish selected interpretations so that industry may take immediate advantage of corresponding proposed revisions. Case Nos. 10, 11, and 12 are published herewith as interim actions of Sectional Committee B31 on the Code for Pressure Piping that will not constitute a part of the Code until formal action has been taken by the ASME and by the American Standards Association on a revision of the Code.

Case No. 10

Inquiry: May blind flanges be made from steel-plate material as well as from forged or cast materials now permitted by the Code?

Reply: It is the opinion of the Committee that blind flanges may be fabricated directly from plate materials with mechanical properties equal to or better than the permissible forged materials. Flanges on which welding may be required should also be of weldable quality.

Case No. 11

Inquiry: May austenitic chromium-nickel alloy steels which are stabilized with columbium plus tantalum be used under Code rules

which are applicable to the use of stainless steel Types 309 Cb, 316 Cb, and 347?

Reply: It is the opinion of the Committee that austenitic chromium-nickel alloy steels, which are stabilized with columbium plus tantalum instead of columbium only, may be used under Code rules which are applicable to the use of Types 309 Cb, 316 Cb, and 347 provided the requirements of the emergency alternate provisions of ASTM Specification A312 are met, except that the requirements for columbium contents shall be as follows:

Columbium—determination not required
Columbium plus tantalum—
1.26 per cent max
8 × the carbon content, min

Until such time as the NPA regulations are canceled, these steels stabilized with columbium alone may be used with a minimum columbium content of 8 times the carbon content. Working stresses shall be the same as those listed for the standard grades stabilized with columbium alone.

Case No. 12

Inquiry: Pending issuance of emergency alternate specifications by ASTM to provide for conservation of critical alloying material, may the molybdenum content of specifications referred to in the Code be lowered by 0.05 per cent?

Reply: It is the opinion of the Committee that the intent of the Code will be met if specifications with a molybdenum range of 0.45 to 0.65 per cent are reduced to 0.40 to 0.60 per cent, and specifications with a range of 0.90 to 1.10 per cent are reduced to 0.80 to 1.00 per cent. The allowable stresses assigned to these respective grades need not be reduced.

Drafting Practices

SECTION 1—Size and Format, one of the sections of the proposed "American Drafting Standards Manual," which is being prepared by the ASA Sectional Committee on Drawings for Drafting Practice, Y14, is now available and is being distributed to industry for criticism and comment.

The manual when completed will cover the standardization of all aspects of engineering drawing and drafting practice.

Anyone wishing to obtain copies of Section 1 may address a request to The American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N. Y., Attention: D. M. Shackelford, Standards Administrator.

ABC Conference

TECHNICAL experts from the United States, Great Britain, and Canada attended the ABC Conference held in the Auditorium of the Engineering Societies Building, 29 West 39th Street, New York, N. Y., June 2–5, 1952, to discuss matters of mutual interest on the important subject of standardization. A similar conference in 1945 led to the 1948 Washington agreement on screw threads. Considerable progress has been made during the intervening years and it is the concerted hope that this work will be continued to a satisfactory conclusion.

The agenda was a full one—complicated and technical—the keynote of the meeting being the discussion of down-to-earth technical standardization problems. Perhaps the most important part of the program was the matter of mutually agreed standards for drawing and drafting practice.

Actually the conference aimed to re-establish the necessity for ABC agreement on basic engineering standards; to see whether any improvements in existing machinery for reaching agreement on unified standards are desirable and practical; to review the program initiated at the Ottawa Conference in 1945, noting the progress since that conference and to redefine the balance of the program; to see whether additional items should be placed on the program; and to consider specifically and technically the following subjects: (*a*) acme threads, (*b*) buttress threads, (*c*) pipe threads, (*d*) threads for gas cylinders, (*e*) limits and fits, and (*f*) drawing and drafting room practice.

The minutes of the conference are being prepared for publication and the release date will be announced in the future.

Junior Forum

Conducted by Joseph Schmerler[1]

Engineers Must Be Utilized to the Best Advantage

THE fact that this country is presently experiencing a critical shortage of engineering talent is well recognized. It is estimated by the Statistical and Education Committees of the Engineering Manpower Commission that a deficit of 60,000 trained engineers exists. This condition will grow worse for the next two years before there is an upswing in the number of engineering graduates to offset the downward trend. The world political situation, however, does not allow us to sit by two years and wait for the additional manpower that is needed. Attention must therefore be focused on better utilization of the available engineering skill in industry and in the Armed Forces.

Better Utilization of Engineers by Industry

Industry has been urged by the Engineering Manpower Commission of EJC to re-evaluate its engineering requirements. The following steps have been advised:

1 Use engineers in jobs where only engineers are required.

2 Do not hold young engineers in "intern" positions longer than necessary.

3 Move engineers to positions of maximum responsibility, compatible with ability and experience.

4 Release engineers from positions not requiring engineering training.

Surveys conducted by a number of private companies and government agencies show that substantial reductions can be made in the number of engineers needed; also that some engineers can be re-assigned to more technical work.

The *Newsletter* of June 1, 1952, issued by the Engineering Manpower Commission reported that in one small division of a large company, a pilot study was made of the time spent by engineers on their various duties. A gain of 15 per cent in engineering time was realized when clerks and engineering aides were assigned to routine duties of matching blueprints and carrying out calculations. Simply because a job requires the use of a slide rule does not mean that it need be assigned to an engineer. Technical institute graduates can usually accomplish most of the ordinary investigations where planning engineers squander too much time.

A government agency, the May 1 *Newsletter* reports, after a review of the skill originally demanded to carry out its work, was able to reduce its future demand by 686 engineers, reduce the skill level of 654 other jobs, and advance 1461 engineers who had not previously been utilized as engineers. Such studies applied on a larger scale, obviously can increase the engineering output of the available manpower and somewhat decrease the apparent shortage.

Any undertaking by industry to make better use of engineers must be directly reflected, in the most part, upon the younger men. They are the source of incoming talent which will be more fruitfully employed. The number of older men who will be shifted to engineering positions must be assumed small. Those who are engaged in sales, administrative, finance, or some other nonengineering position, have generally been away from technical study and application for too long a period to make any substantial contribution if they return now.

Since it is the young engineer who is to be utilized more gainfully, the largest source of latent talent will be found in the drafting room. While it is generally conceded that time spent on the board is good training for an engineer, it must also be admitted that the major part of this work is not of a professional nature. Assignment to draftsman's work need only be for a brief training period before advancement to work requiring creative engineering.

[1] Design Engineer, Celanese Corporation of America, New York, N. Y. Jun. ASME.

Better Utilization of Engineers by the Armed Forces

The Armed Forces, however, present a more difficult problem. The Army has an insatiable appetite for manpower to achieve the goal of containing aggressions against the free world by our enemies. Often, immediate demands for manpower in a particular area do not allow for elaborate screening of a soldier's background to determine the best assignment for him. It is therefore necessary that the man himself initiate the action which will correctly place him in an engineering assignment. The War Department has established a mechanism to achieve this end. Immediately upon induction into the Army, the soldier should file Special Regulation 615 which will assure him of consideration for engineering duty. If he does not file this form, a source of responsible engineering talent may be delegated to minor duties. The majority of last year's engineering graduates who were called into service, some 19,000, are assigned to nonengineering duties.

If the services appear to use the greater portion of the inducted engineering talent in nonengineering positions, and if these engineers could materially aid in the industrial defense build-up, the question may well be asked if these young men are being used to best advantages.

This is, of course, a very difficult point to approach. The duty of military service is before every young man as payment for the privilege of free citizenship. There can be no question that this obligation must be fulfilled in each graduate's postcollege career. Responsible government, however, must answer the question in which capacity a young man can best serve his country. Complete national mobilization would eliminate this problem. With the existing situation, however, criteria are most difficult to establish which will assure that each person is utilized to his highest capability.

This point has been broached from the standpoint of the Armed Forces Reserve Act 1951 (H.R. 5426). In hearings on this bill the EMC has urged the screening of reserve recalls by an agency outside the Department of Defense, specifically the Selective Service System. This stand of EMC finds support in the contents of a talk delivered by General of the Army, Omar N. Bradley, at West Point on April 15th. The General stated, "In many instances we are going to have to compromise our needs to allow the first-rate men to stay with science, and with industry. We may have to override the personal desires of the man himself. As harsh as it may seem, many men who would urgently desire to put on a uniform and participate may have to remain at their posts as civilians in the laboratories and in industry to provide the sinews that this nation's war machines must have."

Selective screening of reserve recalls can also be justified when one considers that the majority of technical jobs in the Army require only technicians or operators. Seldom is a professional engineer actually needed where an engineer is called for. Technicians can be trained in the short span of months, whereas an engineer spends four years at study.

Recalls of all of reservists, in light of the manpower dilemma, should be considered carefully. The problem is to supply the manpower requirements of the services yet not to jeopardize the national security by sapping the critical skills needed in defense industry. Considerable thought needs to be applied to this question, on which national survival might eventually depend. Attention has been focused upon the issue, legislation should supply the effective policy.

Engineering Societies Personnel Service, Inc.

These items are from information furnished by the Engineering Societies Personnel Service, Inc., in co-operation with the national societies of Civil, Electrical, Mechanical, and Mining and Metallurgical Engineers. This Service is available to all engineers, members or not, and is operated on a nonprofit basis. In applying for positions advertised by the Service, the applicant agrees, if actually placed in a position through the Service as a result of an advertisement, to pay a placement fee in accordance with the rates as listed by the Service. These rates have been established in order to maintain an efficient nonprofit personnel service and are available upon request. This also applies to registrant members whose availability notices appear in these columns. Apply by letter, addressed to the key number indicated, and mail to the New York office. When making application for a position include six cents in stamps for forwarding application to the employer and for returning when necessary. A weekly bulletin of engineering positions open is available at a subscription of $3.50 per quarter or $12 per annum for members, $4.50 per quarter for nonmembers, payable in advance.

New York	Chicago	Detroit	San Francisco
8 West 40th Street	84 East Randolph Street	100 Farnsworth Ave.	57 Post Street

Men Available[1]

Mechanical Engineer with electrical training with large manufacturer of electrical equipment, and seven years' experience in Diesel, steam, and electrical power equipment; also refrigeration. Desires responsible position. Speaks and writes Spanish. Me-888.

Mechanical Engineer, 35, BS and MS in ME. Eleven years' varied experience in engine development, superchargers, gas-turbine design, combustion phenomena, and heat transfer. Four years top administrative post. Desires responsibility with future. East. Me-889.

Mechanical Engineer, 24 years' service in India, has excellent knowledge of India. Seeks position with firm having contacts with India as adviser on Eastern affairs. Me-890.

Mechanical Engineer, 29, married, BSME, four years' structural design and test experience. Taking course in business administration. Desires work in design and development. Prefers Southeast. Me-891.

Mechanical Construction Engineer, M.I. plant engineer, 35, married, 15 years' experience on large civil/mechanical construction projects, chemical and power plants, muck shifting plant; specialization, construction planning and plant. Prefers Middle East or Turkey. Knowledge of Greek, Arabic, Turkish. Me-892.

Mechanical and Industrial Engineer, 28, single, two years' diversified experience. Desires position leading to management work with established firm. Me-893.

Positions Available

Chief Product Engineer, electrical or mechanical, ten years' experience in electronic computers, radar, or fire control for electronic instrument manufacturer. $12,000-$15,000. East. Y-7198.

Industrial Engineer, about 35, graduate mechanical or industrial, who has had some experience with electric motors and the standard mechanical equipment, to set up methods, lay background for incentive systems, do estimating, etc. This is a new department and applicant would have complete charge of all industrial-engineering functions. Permanent. About $9000. New England. Y-7214.

Mechanical Engineer to take complete charge of a small existing research and development group specializing in mechanical and machinery design, for research organization. Should have specialized in some mechanical field and had from five to 15 years' experience. $8000-$10,000. Texas. Y-7217.

Engineers. (*a*) Chief design engineer, 40-45, at least five to ten years' experience in the design of machine tools, small power tools used in light metal manufacturing. $8000-$10,000 plus profit sharing. (*b*) Assistant to afore-mentioned. Salary open. Northern N. J. Y-7219.

Mechanical or Electrical Engineer, young, with insulated-wire experience in polyethylene or vinyl fields for test and production duties. Salary open. Westchester County, N. Y. Y-7222.

Designer, mechanical graduate, with plant engineering experience in process and industrial power fields, to design and lay out cement-mill equipment. $5100. Central Ohio. Y-7223.

Methods Engineers, mechanical graduates, with considerable experience in machine-shop practice and experience on time and motion study for medium-sized machine tools. $7000-$10,000. Long Island, N. Y. Y-7227.

Production-Standards Manager, 35-45, who has had considerable experience in industrial engineering, i.e., estimating, processing, methodizing and production standards. Should have had industrial experience involving steel fabrication, tooling, heavy and light machinery, and handling equipment, modern assembly-line methods, plating, heat treating, and metal finishing; a proved record of cost reduction. Should have had some previous experience as chief production estimator, assistant chief industrial engineer, or chief process engineer. Company is engaged in the research, development, and fabrication of automotive, aircraft, and home heating equipment. $7800-$9000. Midwest. Y-7229.

Technical Writer, mechanical or chemical graduate, experience covering process equipment specifications, and operating procedures to prepare articles covering water conditioning, power generation, and general industrial process work. $4800-$6600. Del. Y-7235.

Development Engineer, young, mechanical, electrical, or chemical graduate, process-equipment experience, to run plant tests on process equipment, write reports, make drawing changes on layouts, and supervise field installations. Considerable traveling. $4830-$6000. Headquarters, central N. J. Y-7236.

Engineers. (*a*) Chief engineer, electrical or mechanical graduate, not over 45, for design and development, and to take complete charge of a small engineering department for an electrical appliance manufacturer. Must have a minimum of five years' experience in the electrical appliance field. $8000-$10,000. (*b*) Junior engineer to assist above engineer on laboratory investigation and model work on electrical appliances. $5000-$6000. Conn. Y-7237.

Mechanical Engineer, graduate, two to three years' experience, preferably in steam-power-plant calculation and design. Some stress analysis, particularly on pipe layout desirable, for work in calculation section for engineering architect firm. $5000-$6000. Philadelphia, Pa. Y-7239.

Engineers. (*a*) Industrial engineer, young, for staff of consulting engineers, preferably with some

(*ASME News continued on page 702*)

[1] All men listed hold some form of ASME membership.

Pacific Gas & Electric buys additional

YARWAY

FLAT GLASS GAGES

Pacific Gas and Electric Company—a big factor in sunny California's amazing development—has used Yarway steam plant equipment a long time.

For instance, Yarway Pressure Sealed Flat Glass Gages have been specified in five of their new plants. Yarway glasses have been ordered for pressures from 1475 psi to 2050 psi. P G and E is just one of many companies who have used Yarway Flat Glass Gages for high pressure installations.

Longer gage life results from the "floating assembly" feature. Glass breakage and leakage is reduced. Newest feature is the Yarway Type M Illuminator which causes meniscus at water level to continue to *shine like a star*... even under adverse conditions.

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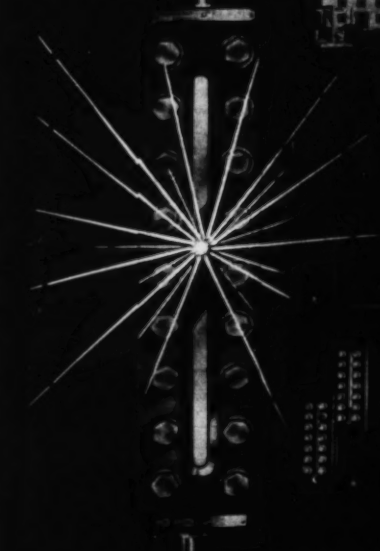
California calls for Yarway again...

Contra Costa Steam Plant

Moss Landing Steam Plant

Kern Steam Plant



YARWAY SERVICE GOES ALL THE WAY

experience in time study, incentives, shop layouts, etc. Some traveling. $6000-$8000. New York, N. Y. (*b*) **Industrial engineer**, three to five years' experience in time study, methods, and incentive for about one year's work in Puerto Rico. $8000-$10,000. Y-7240. Mr. Meyer.

Engineers. (*a*) Designers, electrical or mechanical, with experience on computers, simulators, servomechanisms, etc. $6000-$6500. (*b*) Junior engineer with two to three years' experience in similar work as above. $4680. New York, N. Y. Y-7241.

Assistant Professor in mechanical engineering, to teach mechanical subjects such as kinematics, machine design, etc. Some laboratory practice. $4800. Va. Y-7242.

Executive Vice-President and Director, 38–45. ME degree desirable, thorough background in the mass production of sheet-metal products, and proved ability as an administrator, for a small, nationally known manufacturer of consumer durable goods producing light metal component for commercial use. $18,000. Chicago metropolitan area. Y-7251.

Product-Development Engineer, electrical or mechanical, up to 40, three years' experience in engineering and administration work in area of precision or intricate mechanisms. Should be creative thinker. Duties will include research and development to improve products. Both engineering and administrative duties for manufacturers of dental, electric, and aircraft equipment. Company may negotiate placement fee. $15,000–$20,000. Upstate N. Y. Y-7252-R-8080.

Engineers. (*a*) Mechanical engineer, young, graduate, experienced in design and development for a large electric company. Should have three or four years' experience. $7500–$9000. New York, N. Y. Y-7253(*a*).

Materials-Handling Engineer, 30–40, mechanical or industrial engineer. Will consider civil engineer with survey, planning and layout experience for engineering duties with consulting firm. Considerable traveling. Salary, $6000 a year plus bonus. Location, New York, N. Y. Y-7270.

Director of Development and Research, graduate engineer, with considerable experience in setting up a development laboratory, with particular experience with equipment involved in paper converting operations. $12,000–$15,000. Eastern Pa. Y-7271.

Engineer, BS or AB degree in mechanical, chemical, or industrial engineering, 35–45, to organize and direct specific services groups, including stores and warehouse, transportation, protection, safety, fire, and cafeteria. $8000–$10,000. (*b*) Technical librarian, 25–45, with chemical background, to set up a library. Should be able to read both French and German. Salary open. Ala. Y-7273.

Engineers. (*a*) Manufacturing engineer, mechanical, ten years' experience in manufacturing, five of which have been as manufacturing or industrial engineer and three years directing the work. Knowledge of foundry, machining, and assembly operations. Will develop manufacturing programs co-ordinated with production methods, standard costs, and time studies. Set up controls and data reports for a manufacturer of pumps. $10,000–$12,000. (*b*) Director of product development, mechanical, ten years' experience in designing mechanical consumer products, three of which should have been in supervisory capacity. Knowledge of foundry and machining operations and stylizing. Will direct development of product programs and set up tests, research, and cost schedules. Will also provide technical information for sales and service departments for a manufacturer of pumps. $12,000–$15,000. Ohio. Y-7275-T-9004.

Professor, considerable experience in practical industrial management, to head up a new course in this subject. Any experience in management consulting or business administration desirable. $7000–$10,000. New York, N. Y. Y-7276.

Manager of Materials Handling, for a multiplant operation manufacturing parts and instruments for the aircraft and automotive industries. Experience should include inventory control, production planning, production control, purchasing, preferably with large companies in aircraft-parts industry. $8000–$12,000, depending on experience. New York metropolitan area. Y-7278.

Engine Designer, mechanical graduate or equivalent, several years' experience in basic design of two and four-cycle engines of the air-cooled type. Should possess executive ability or organize and supervise work of other designers and test engineers in the completion of projects involving development of a new line of 3, 5, and 7-hp engines. To $12,000. Midwest. Y-7281-D-7678.

Office Engineer, 30–35, mechanical-engineering training, at least five years' experience covering installation and construction of piping and mechanical equipment for power, petroleum, and chemical industries, to do estimating, project engineering for piping contractor. $6500. New York, N. Y. Y-7296.

Master Mechanic, up to 55, five years' experience in maintenance of sheet-metal fabrication, conveyers and machine tools, and tools and dies. Knowledge of machine-shop operations. Will supervise maintenance crews working on production equipment. Will supervise about 200 people and check preventable maintenance for a manufacturer of sheet-metal fabrication. $8000–$9000. Company may negotiate placement fee. Ill. R-8961.

Design-Development Engineer, mechanical, several years' experience in design and development on heavy equipment, mining equipment preferred. Knowledge of mechanisms, electrical control, and machinery applications desirable. Will be required to make field investigations, do some board work, and engage in engineering department activities for a manufacturer of mining equipment. Should have design ability, commercial slant, and potentialities for developing administrative ability. About $6000–$7200. Company will pay placement fee. Ill. R-9008.

Chief Engineer, mechanical, five years' experience in general shop engineering work. Knowledge of punch press and machine operations. Will design mechanisms and hardware for jalousies; working with outside vendors, purchasing parts and co-ordinating shop and engineering activities for a manufacturer of hardware. Employer may negotiate placement fee. $7500–$10,000. Ill. R-9030.

Candidates for Membership and Transfer in the ASME

THE application of each of the candidates listed below is to be voted on after Aug. 25, 1952, provided no objection thereto is made before that date and provided satisfactory replies have been received from the required number of references. Any member who has either comments or objections should write to the secretary of The American Society of Mechanical Engineers immediately.

KEY TO ABBREVIATIONS

R = Re-election; Rt = Reinstatement; Rt & T = Reinstatement and Transfer to Member.

NEW APPLICATIONS

For Member, Associate, or Junior

AYLING, DONALD A., West New York, N. J.
BAKER, RAYMOND, SR., Philadelphia, Pa.
BENSON, WILLARD R., Dover, N. J.
BONER, WILLIAM E., Lynwood, Calif.
BOWERS, HENRY J., Dayton, Ohio
BRATT, HARRY T., St. Paul, Minn.
BROUWERS, ALEXANDER, Rotterdam, Holland
BURDICK, GEORGE E., Boston, Mass.
CALDWELL, WILLIAM I., Rochester, N. Y.
CASTLE, HENRY F., Birmingham, Mich.
CHASE, FRANK F., Brooklyn, N. Y.
CILLEY, KENNETH D., Stoneham, Mass.
CISEWSKI, JOHN W., Bayonne, N. J.
CLAITOR, L. C., Jeannette, Pa.
CLEAVER, HOWARD W., Canton, Ohio
COUCH, ROBERT T., Charleston, W. Va.
CRANE, GEORGE W., Dayton, Ohio
CURTIS, ROBERT W., New York, N. Y.
DANBERG, CHARLES, Mattapan, Mass.
DRAB, JOSEPH B., San Francisco, Calif.
DUNAWAY, J. L., Dallas, Texas
DUNLAVY, VERNON A., JR., Vallejo, Calif.
FOLK, SAMUEL B., Columbus, Ohio
FORRESTER, W. K., Oak Ridge, Tenn.
FOX, HARRY D., Williamsburg, Mich.
GRIGER, GENE E., Pittsburgh, Pa.
GREENEISEN, PAUL, Canton, Ohio
GREER, EDISON, Pomona, Calif.
HAGERMAN, K. C., Hastings-On-Hudson, N. Y.
HASHIMOTO, S. J., Tokyo, Japan (Rt)
HEATH, ROBERT L., San Rafael, Calif.
HEILICZER, JOSEPH, New Brunswick, N. J.
HILTON, MERLE B., Knoxville, Tenn.
JACOBS, HADLEY, Chattanooga, Tenn.
JENKS, A. W., Salt Lake City, Utah
JENNINGS, FREDERIC B., Beverly, Mass.
JEPSON, PAUL D., Toledo, Ohio
JORGENSEN, F. A., Louisville, Ky.
KERR, DOUGLAS M., Dallas, Texas
KORN, K. THEODORE, Cleveland, Ohio
KOWALSKY, WILLIAM, New York, N. Y.
LARSON, ALEXANDER G., Cincinnati, Ohio
LASSEN, ROBERT M., Army Chemical Center, Md.
LEDERER, ALBRECHT M., New York, N. Y.
LE MAY, ROBERT C., Philadelphia, Pa.
LINEBERRY, W. A., Old Hickory, Tenn.
LU KENG, D. E., Los Angeles, Calif.
LUNDBERG, ROBERT M., Chicago, Ill.
MARTIN, JAMES W., South Milwaukee, Wis.
MC CRAW, HOWARD C., Oak Ridge, Tenn.
MILLER, MARTIN S., Reading, Pa.
MILNER, D. C., Akron, Ohio
MIRES, RAYMOND N., Houston, Texas
MORGAN, WILLIAM R., Cincinnati, Ohio
MORRIS, EDWIN W., Los Angeles, Calif.
MOYER, WILLIAM H., Alliance, Ohio
MURRER, E. E., Mountain Lakes, N. J.
O'HAIN, WILLIAM L., Lynchburgh, Va.
O'HARE, DON R., Bryn Mawr, Pa.
PACE, ANTHONY J., Bellerose, L. I., N. Y.
PERKINS, ROY B., JR., Chicago, Ill.
PETERS, EDWARD L., University Park, Md.
PHILLIPS, JAMES W., Salt Lake City, Utah
POU, FRANK E. S., Atlanta, Ga.
PRICHARD, ALBERT W., JR., Knoxville, Tenn.
RIOS PRUNEDA, ARMANDO, Mexico, D. F., Mex.
ROSS, ROBERT A., San Juan Capistrano, Cal.
SAAVEDA GARCIA, MIGUEL, Mexico, D. F., Mex
SCHUBLER, JURGEN B., Ridgewood, N. J.
SHIPPEL, CLAUDE, Baden, Switzerland
SHARPLESS, CHARLES T., JR., Springdale, Pa.
SIDHESWAR, N. S., Anantapur, S. India
SIMS, J. BRYAN, Grand Haven, Mich.
SNYDER, W. G., Louisville, Ky.
SPIEGELMAN, STANLEY, Brooklyn, N. Y.
STEVENS, ALFRED D., Latrobe, Pa.
STUCKEY, EDWARD E., Port Arthur, Texas
STUDENT, KURT R., Lakewood, Ohio
SUBRAMONIAN, P. S., Trivandrum, S. India
SUTTER, CLARENCE A., Peoria, Ill.
SUTTON, NORTON H., White Plains, N. Y.
SZENDEL, STEPHAN JR., Portland, Ore.
TEARS, STUART K., Dallas, Texas
TEN EYCK, EVERETT K., Bayside, L. I., N. Y.
THOMAS, WILLIAM N., Philadelphia, Pa.
THORNHILL, THOMAS J. JR., Houston, Texas
WADE, JAMES R., Army Chemical Center, Md.
WAXMAN, ROBERT J., Philadelphia, Pa.
WEISMANN, G. F., Temple City, Calif. (Rt&T)
WEISS, HASKELL, Newark, N. J.
WICK, CHARLES H., Seaford, L. I., N. Y.
WILLIAMS, DAVID G., Houston, Texas
WILSON, CLAUDE L., Prairie View, Texas
ZAWORSKI, ROBERT J., Cabimas, Zulia, Venezuela, S. A.
ZEPPLER, LOUIS H., Cranford, N. J. (Rt)
ZINN, ROBERT E., Wilmette, Ill.
ZUDANS, ZENONS, São Paulo, Brazil, S. A.
ZWEIF, DONALD N., Fort Collins, Colo.

CHANGE IN GRADING

Transfers to Member and Associate

BUMSTEAD, ROBERT, Philadelphia, Pa.
CASPELL, EDWIN E., Hamden, Conn.
DYKMAN, JOHN C., Vestal, N. Y.
KLEBACH, GERALD, Berkeley, Calif.
PLOURNOY, SPENCER, New York, N. Y.
PURMAN, GEORGE R., Glenham, N. Y.
GARTZ, W. J., Chicago, Ill.
GILLIS, ALPHONSE P., Chicago, Ill.
HEIDERSBACH, FRITZ G., New York, N. Y.
JOHNSON, THEODORE W., JR., Annapolis, Md.
KELLY, RAYMOND F., Panama City, Fla.
MANGAN, JOHN L., St. Louis, Mo.
MCVEY, JOHN W., Pittsburgh, Pa.
MILLER, F. DANA, Rochester, N. Y.
SAWYER, FRED A., Boston, Mass.
SCHIFF, HENRY, Yonkers, N. Y.
SHANAHAN, JOHN J., Winchester, Mass.
SHEA, THOMAS M., Colmar, Pa.
SOSSNER, THEODORE T., Forest Hills, N. Y.
THOMAS, A., EMIL, Charlotte, N. C.
TODARO, ANDREW C., Charlestown, Ind.
WALDRON, JEROME H., New Brunswick, N. J.
WOLFF, JOHN F., JR., Jenkintown, Pa.

Transfer from Student Member to Junior.....175

Obituaries

Paul Adams (1892–1952)

PAUL ADAMS, supervisor, design and drafting, Hood Rubber Co., Watertown, Mass., died March 9, 1952. Born, Dorchester, Mass., July 21, 1892. Parents, James W. and Pauline F. (Hayden) Adams. Education, 2 years, Massachusetts Institute of Technology. Married, Ann M. Lyons, 1919. Mem. ASME, 1942. Survived by wife.

(*ASME News continued on page 704*)

No more "*off the cuff*" decisions when you compare blower values

Type H, 2-Stage Centrifugal Exhauster in Montana mine service. Capacity 18,100 cfm.

- ☐ Choice of Rotary or Centrifugal
- ☐ Capacity matched to the job
- ☐ Easy accessibility
- ☐ Ruggedness
- ☐ Ease of installation
- ☐ Ability to handle overloads
- ☐ Long-time durability
- ☐ Freedom from breakdowns
- ☐ Low maintenance costs
- ☐ Engineering assistance
- ☐ Proved reputation of maker
- ☐ Customer satisfaction

If you are considering new equipment for handling gas or air, we suggest you consider the essential values listed above, before you make your final selection. These factors will help you determine the unit that will best match your specific application, and that will give you the most satisfactory, economical performance.

You'll find that R-C equipment rates high in every one of these essential factors. With capacities ranging from 10 cfm to 100,000 cfm or higher, at moderate pressures, and with the exclusive *dual-ability* line of Centrifugal or Rotary Positive types, you have a wide choice to meet the most exacting needs.

If you'd like to tell us about your specific problem, we'll gladly send detailed information for comparison, or supply engineering help from our 98 years of blower building experience.

ROOTS-CONNERSVILLE BLOWER CORPORATION
522 Michigan Avenue, Connersville, Indiana

ROTARY

Type HD Gas Exhauster in coke-making plant.

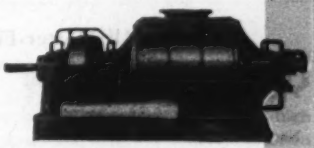
Reg. U.S. Pat. Office

THE *DUAL-ABILITY* LINE OF MODERN EQUIPMENT TO HANDLE GAS AND AIR

Multi-Stage Centrifugal Exhausters

Single-Stage Centrifugal Blowers

Rotary Positive Blowers



Rotary Positive Gas Pumps

Positive Displacement Meters

Inert Gas Generators

ROOTS-CONNERSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC.

Earl A. Averill (1878–1950)

EARL A. AVERILL, consulting engineer, Adams, N. Y., died April 3, 1950. Born, Richland, N. Y., Aug. 13, 1878. Parents, Edgar E. and Emma (Magee) Averill. Education, ME, Cornell University, 1900. Married Bertha Waite, 1905. He was the author of many technical articles and held several U. S. Patents on feedwater heaters and other locomotive appliances. Mem. ASME, 1940. Survived by wife and son, Edgar W.

Jesse L. Best (1887–1952)

JESSE L. BEST, superintendent of utilities, Anheuser-Busch, Inc., St. Louis, Mo., died May 7, 1952. Born, Witt, Ill, June 9, 1887. Parents, Ernest D. and Louisa (Kraft) Best. Education, high-school graduate; ICS courses in electrical and mechanical engineering. Married Olive M. Brenner, 1909. Jun. ASME, 1914; Mem. ASME, 1921. Survived by wife and four children, Mrs. Jessie St. Jean, Robert L., Mrs. Camilla Crenshaw, Everett B.

Algernon Rex Burnette (1882–1952)

A. REX BURNETTE, consulting engineer, Burns and Roe, Inc., New York, N. Y., died May 2, 1952, while on a business trip to Camaguey, Cuba. Born, Hoboken, N. J., June 12, 1882. Parents, Harry H. and Katherine (Desrin) Burnette. Education, Stevens Institute of Technology. Married Gladys Degen Adams, 1915. Married 2nd, Alfreda Dahme, 1940. Mem. ASME, 1920. Survived by wife; a sister, Maude Burnette, and a brother, Will.

James Raymond Clancy (1897–1952)

JAMES R. CLANCY, commercial engineer, N. Y. & Queens Electric Light & Power Co., Long Island City, N. Y., died May 3, 1952. Born, Brookfield, Mass., July 4, 1897. Parents, John F. and Katherine (Harrington) Clancy. Education, BS(ME), Tufts College, 1922; New York University school of accounting and finance, 1933–1934. Married Irene G. Maher, 1936. Jun. ASME, 1924; Assoc-Mem. ASME, 1932; Mem. ASME, 1935. Survived by wife, two children, Helen G. and Virginia I.

Jacob Henry Czock (1897–1952)

JACOB H. CZOCK, special representative, Engine Division, National Supply Co., Oakland, Calif., died in Salt Lake City, Utah, May 8, 1952, while on company business. Born, Minneapolis, Minn., July 25, 1897. Parents, John and Pauline Czock. Education, BS, University of Minnesota, 1920. Married Mildred Postell, 1925. Mem. ASME, 1941. Survived by wife and daughter, Mrs. Frederick Amery, Oakland, Calif.

David Dasso (1891–1952)

DAVID DASSO, Peruvian engineer formerly associated with several firms in the United States, died May 18, 1952, in Lima following a heart attack. Born, Lima, Peru, S. A., Feb. 25, 1891. Parents, Andres and Mary (Hloke) Dasso. Education, School of Engineering, Lima; BS(ME), Massachusetts Institute of Technology, 1912. Married Olga Raffo, 1921; children, Carlos, Dows. During World War II he served his country as Minister of Finance and Commerce. He worked closely with the United States at that time and succeeded in concluding several trade agreements with this nation. Jun. ASME, 1912; Assoc-Mem. ASME, 1921; Mem. ASME, 1933.

James Arthur Day (1907–1952)

JAMES A. DAY, superintendent, Riverside Steam Station, New York Power & Light Corp., Albany, N. Y., died March 25, 1952. Born, Hopedale, Mass., Oct. 17, 1907. Parents, Willard E. and Eleanor R. (Thompson) Day. Education, Wentworth Institute, Boston, 1927. Married Elizabeth Edna Capen, 1930; daughter, Elizabeth E. Jun. ASME, 1935.

Walter W. Flatow (1914–1952?)

WALTER W. FLATOW, whose death was recently reported to the Society, was a project engineer, Atlas Boiler Co., Spokane, Wash. Born, Berlin, Germany, Dec. 2, 1914. Parents, Julius and Kate Flatow. Education, ME, Beuth College of Engineering, Berlin, 1937. Naturalized U. S. citizen, South Carolina, 1944. Author of several papers he had published in technical journals, Jun. ASME, 1945.

Frederick Montague Gibson (1877–1952)

FREDERICK M. GIBSON, retired plant engineer, American Sugar Co., Brooklyn, N. Y., died May 15, 1952. Born, Dover, N. J., Nov. 17, 1877. Parents, John S. and Ella (Gordon) Gibson. Education, ME, Stevens Institute of Technology, 1901. Married, Ethel Tonis, 1908 (died 1947). In 1951 he received the Alumni Award of Stevens Institute. Mem. ASME, 1913. He served the Society as secretary, Special Research Committee on Sampling Pulverized Fuel in a Moving Gas Stream; as ASME representative, Joint AIME-ASME Committee on Fuel Value; and as chairman, for many years, Subcommittee on Care of Steam Boilers and other Pressure Vessels in Service, of the Boiler Code Committee. Survived by a son, Frederick M., Jr.; two sisters, Mildred and Mrs. James Muir; and a grandson.

John Alexander McGrew (1873–1952)

JOHN A. MCGREW, retired engineer and inventor, died May 7, 1952, in St. Peters Hospital Albany, N. Y. Born, Bridgewater, Ohio, June 8, 1873. Education, CE, Ohio State University, 1895; postgraduate work, 1895–1896. His inventions include a lock washer, locomotive booster rail anchor, and uniflow locomotive. Mem. ASME, 1916.

Francis Graham McKelvy (1883–1952)

FRANCIS G. MCKELVY, chairman of the board Alpha Portland Cement Co., Easton, Pa., died May 7, 1952. Born, Pittsburgh, Pa., Aug. 9, 1883. Parents, William M. and Frances (Graham) McKelvy. Education, BA, Princeton University, 1904. Married Louise Corwin, 1910; children, Louise Makepeace, William Graham. Mem. ASME, 1922. With J. E. Bell he patented a design for a waste heat boiler for cement plants.

Keep Your ASME Records Up to Date

ASME Secretary's office in New York depends on a master membership file to maintain contact with individual members. This file is referred to dozens of times every day as a source of information important to the Society and to the members involved. All other Society records and files are kept up to date by incorporating in them changes made in the master file.

From the master file are made the lists of members registered in the Professional Divisions. Many Divisions issue newsletters, notices of meetings, and other materials of specific interest to persons registered in these Divisions. If you wish to receive such information you should be registered in the Divisions (**no more than three**) in which you are interested. Your membership card bears key letters opposite your address which indicate the Divisions in which you are registered. Consult reverse side of card for the meaning of the letters. If you wish to change the Divisions in which you are registered, please notify the Secretary's office.

It is important to you and to the Society to be sure that your latest mailing address, business connection, and Professional Divisions enrollment are correct. Please check whether you wish mail sent to home or office address.

For your convenience a form for reporting your address, business connection, and Professional Divisions enrollment is printed on this page. Please use it to keep the master file up to date.

Four weeks are required to complete master-file changes.

New Membership List in Preparation

Please be sure to include your present business title and name of company. See box below

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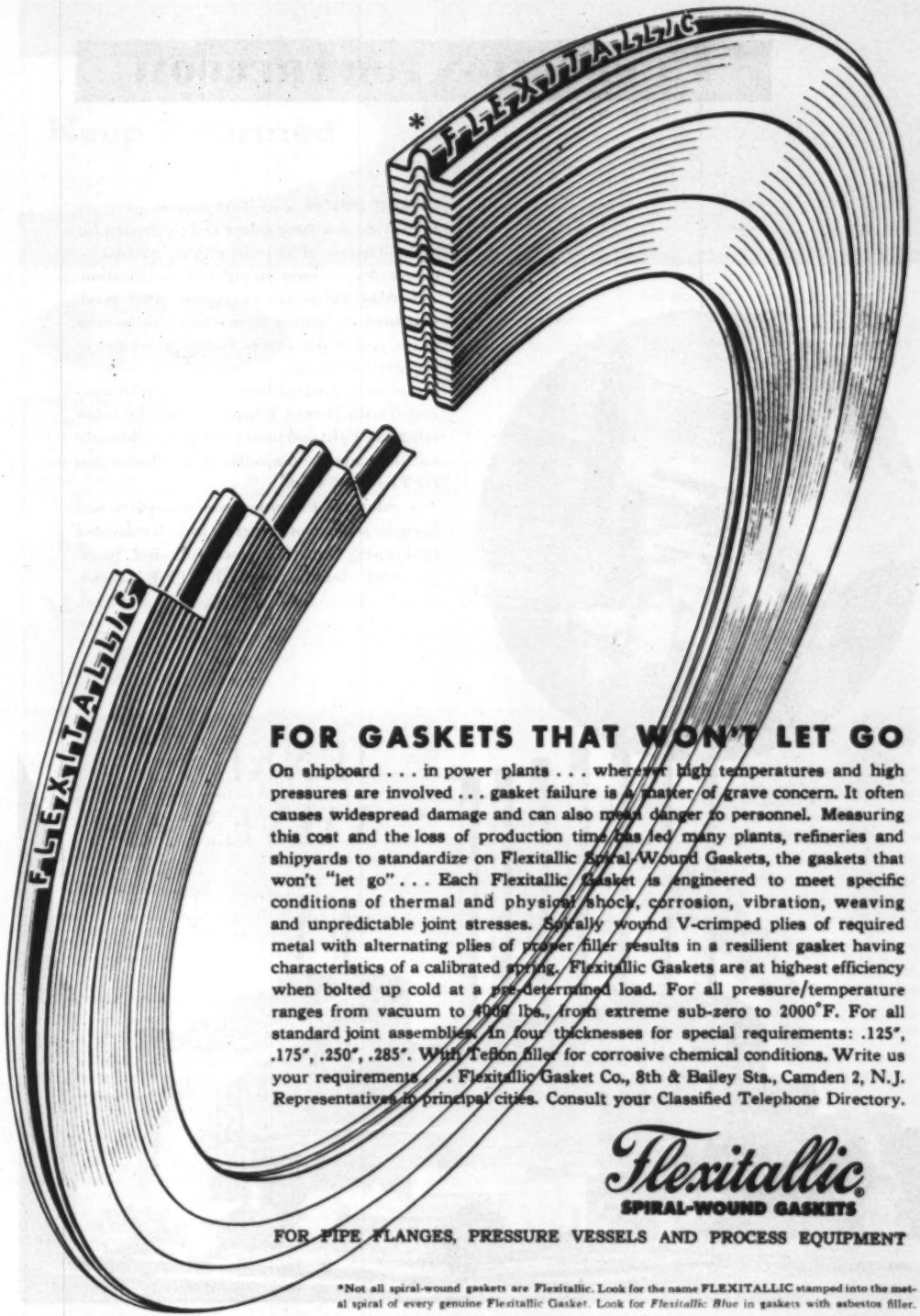

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On shipboard . . . in power plants . . . wherever high temperatures and high pressures are involved . . . gasket failure is a matter of grave concern. It often causes widespread damage and can also mean danger to personnel. Measuring this cost and the loss of production time has led many plants, refineries and shipyards to standardize on Flexitallic Spiral-Wound Gaskets, the gaskets that won't "let go" . . . Each Flexitallic Gasket is engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses. Spirally wound V-crimped plies of required metal with alternating plies of proper filler results in a resilient gasket having characteristics of a calibrated spring. Flexitallic Gaskets are at highest efficiency when bolted up cold at a pre-determined load. For all pressure/temperature ranges from vacuum to 4000 lbs., from extreme sub-zero to 2000°F. For all standard joint assemblies, in four thicknesses for special requirements: .125", .175", .250", .285". With Teflon filler for corrosive chemical conditions. Write us your requirements . . . Flexitallic Gasket Co., 8th & Bailey Sts., Camden 2, N.J. Representatives in principal cities. Consult your Classified Telephone Directory.

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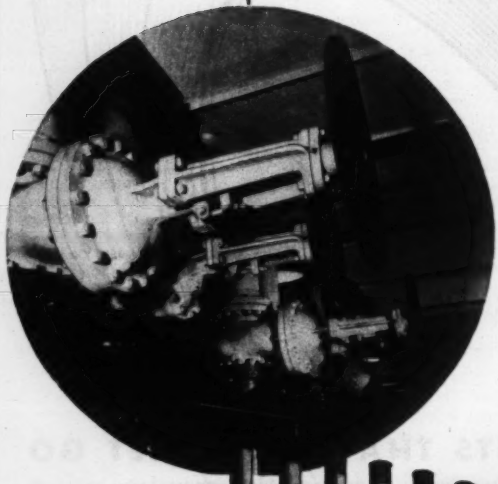
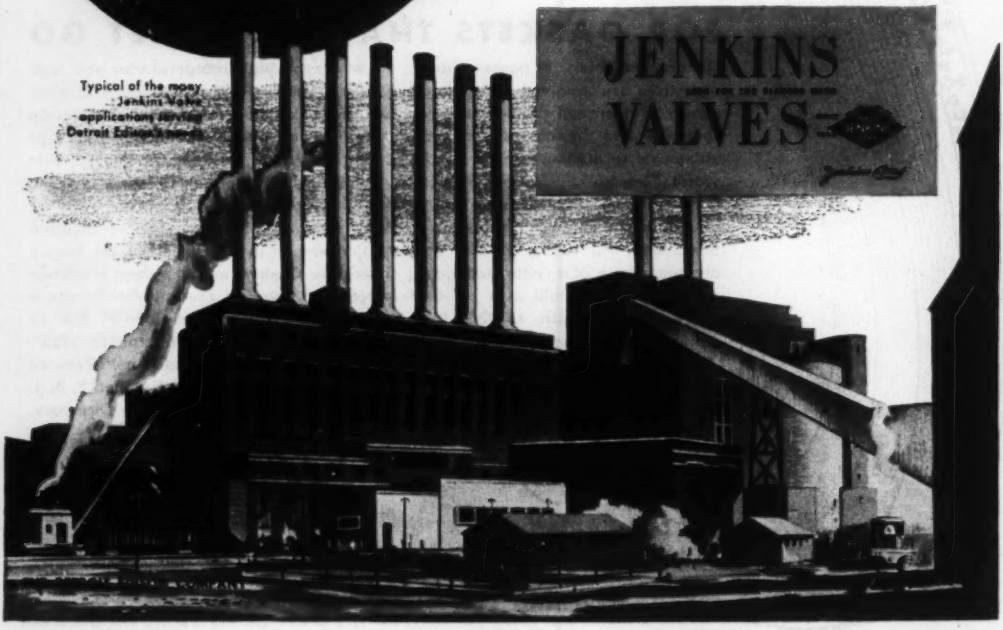
DETROIT EDISON — in its expansion program to provide still more power and protection for the industries of Detroit, mighty arsenal of democracy, — buys on strictest specification.

Jenkins Valves are among the many products used in Detroit Edison's expansion program, geared not just to current need but to long-term economy.

Naturally Jenkins Bros. is proud to be associated with Detroit Edison, — and the many other fine light and power companies throughout the nation, — in celebrating "Production for Freedom" week.

A salute to the enterprise, initiative, and business acumen of this great industry devoted to keeping America power-full and hence *powerful!* Jenkins Bros., 100 Park Avenue, New York 17. Jenkins Bros., Ltd., Montreal.





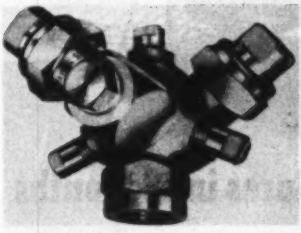
Typical of the many Jenkins Valve applications serving Detroit Edison's power

Keep Informed

New Equipment

Boomjet Spray Nozzle

Mounted on a tractor, truck, or Jeep, here is a new spray nozzle for spraying to a width of up to 66 ft. using only this single nozzle assembly for the job. Named the Spraying Systems BoomJet nozzle—No. 5430-$^3/_4$-2TOC—this nozzle provides full coverage over the entire width of the spray pattern.



The assembly consists of five nozzle tips: two of the tips are swivel mounted for adjustment; together the five tips give a balanced coverage of spray across the pattern area. As shown in the illustration, spray is directed equally to either side of the BoomJet. Also supplied in a similar design for spraying to one side only. Designed for field and road spraying of every kind. Built in range of sizes, to give capacities, depending upon pressure, of from 1.0 to 20.8 gpm. For complete information write Spraying Systems Co., 3265 Randolph St., Bellwood, Ill.; ask for Data Sheet 5430.

Single-Phase Variable-Speed Motor

A new development in single phase variable speed motors in fractional horsepower is announced by U. S. Electrical Motors Inc. As a modification of the Company's Type VA Varidrive line, the new motor permits use of 110 of 220 volts. It is designated as Type VA-C Varidrive and is made in $^1/_8$, $^1/_3$, $^1/_2$, and $^3/_4$ hp. This compact, lightweight motor provides speeds in a 10:1 ratio with the range from 4 to 10,000 rpm. Merely by turning a convenient control dial, the motor's speed can be instantly changed to a desired speed without stopping. It eliminates the necessity of an external speed-changing device or gearbox and occupies little more room than a standard fixed speed motor. An illustrated bulletin, No. 1601, giving full details may be obtained from U. S. Electrical Motors Inc., Box 2058, Los Angeles 54, Calif

pH Control

Acid and alkaline wastes at a well-known New England textile finishing plant are effectively neutralized under Foxboro pH Control, furnishing conditions for optimum biological activity and efficient waste disposal.

The separate wastes are collected in equalization tanks. To create a neutral pH condition in the underground mixing basin, a closely regulated flow of acid waste is mixed with the alkali. The resulting effluent is then further treated on trickling filters.

pH is controlled by a Foxboro Recording Dynalog Controller located in the pump house. A small circulating pump supplies a continuous sample to a flow-type electrode. As the measured pH changes, the controller operates a 3-in. rubber-lined Saunders patent valve in the acid line to maintain the desired condition.

Since the efficiency of this waste disposal system depends on an unchanging neutral pH, control is automatically maintained within the desired tolerance limits despite variations in acid and alkaline waste concentration and rates of flow

Description of a similar waste-disposal installation is contained in Data Sheet 833-5. Copies will be sent on request from The Foxboro Co., 26 Neponset Ave., Foxboro, Mass.

Aero After Cooler

Niagara Blower Co., 405 Lexington Ave., New York 17, N. Y., announces a new improved design of the Niagara Aero After Cooler, for compressed air or gases, in which the cooling capacity of the units is increased from 25% to 75% over previous models.

Cooling is done by the evaporation of recirculating water sprays on the surface of tubes through which the compressed air passes. The increased capacity in the new models is gained by improved distribution of the compressed air in the machine and increase in the amount of evaporating surface. Tube sizes have been increased to reduce friction. The equipment is designed for installation outdoors to provide cleaner compressed air and save space in industrial buildings. Freezing is prevented in winter by automatic control which shuts off freezing cold air from the spray chamber.

The cooling medium is air at the atmospheric wet bulb temperature which is cooler than the average summer temperature of surface cooling water. The Niagara Aero After Cooler, therefore, is reported to remove more moisture from compressed air than after coolers using surface water. Also since the compressed air is always cooled below the atmospheric dry bulb temperature it prevents condensation in compressed air lines, and damage to pneumatic tools, paint sprays and plant processes.

The Aero After Cooler consumes less than 5% of the cooling water required by conventional after coolers.

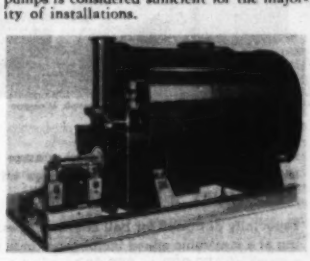
Oil Booster

The introduction of a new heavy-duty, high-temperature oil booster to join its already successful line of road machinery asphalt heating equipment has been announced by the Cleaver-Brooks Co., Milwaukee, Wis.

The high-temperature oil booster is a self-contained fully-automatic heating unit operating on the principle of a closed heating system, vented to atmosphere. It provides higher temperatures with lower fuel costs and less maintenance, according to Cleaver-Brooks.

Features of the oil booster include quicker heating, reduced maintenance, quicker shutdown, positive heat circulation, higher temperatures, lower operating costs, and trouble-free design.

The unit is always at atmospheric pressure. Pressure developed by the circulating pumps is considered sufficient for the majority of installations.



A semielliptical shell contains the heating element at the bottom which is free floating and easy to remove. Adequate space in the top of the unit makes possible double expansion of heat transfer oil, or depending upon the additional oil needed to charge an installation for the equipment to be served.

The high-temperature oil booster enables the user to maintain higher temperatures in heating bituminous and heavy viscous material employing high-temperature oil. A tight coil system guarantees a negligible loss of heat transfer oil through evaporation.

The new Cleaver-Brooks unit is fired by a pressure-atomizing-type oil burner suitable for oil having a viscosity not exceeding 50 sec Saybolt Universal.

Mounted integrally on the unit are pump, valves, piping, temperature and low-level oil controls, and the electric motor and controls. The entire unit, ready for service line hookup, is mounted on a heavy channel iron base.

The high-temperature oil booster is currently available in two sizes of stationary electric driven units. Users interested in refinery or other special applications are asked to consult their local Cleaver-Brooks representatives or the engineering department, Cleaver-Brooks Road Machinery Div.

DOW CORNING SILICONES

make motors last longer

Photo courtesy Whirlpool Corporation, St. Joseph, Michigan

Saved Six $1200 Failures in 18 Months

In exhausting fumes from a line of paint spray booths, this 20 hp fan motor repeatedly painted itself to death. After about 3 months of service, the paint built up so heavily on the fan blades that the motor burned out. Each failure halted production on a 300 man assembly line; cost over 450 man hours or about $1200 per failure.

Maintenance engineers had to choose between having the fan cleaned every day, installing a larger motor, or rewinding the old one with Dow Corning Silicone (Class H) Insulation. The economy of choosing Silicone insulation is proved by the fact that this motor, rewound with Class H materials, has been operating 20 hours a day for over 18 months, or 6 times its previous life. Savings so far amount to about $7200.00.

Such performance in thousands of installations has proved that Dow Corning Silicone (Class H) insulation has 10 to 100 times the life expectancy of the next best class of insulating materials; increases the power per pound ratio in electric machines by as much as 50%.

Eliminate another common cause of motor failure; lubricate bearings with Dow Corning 44 Silicone Grease.

Especially designed for ball bearings operating at a maximum speed factor (bore in m.m. x rpm) of 150,000 to 200,000 and at temperatures from —40° to 400°F, Dow Corning 44 Grease is practically nonvolatile and highly resistant to oxidation. In open and single shielded bearings designed for high temperature operation, Dow Corning 44 has 8 to 10 times the life expectancy of conventional greases. It gives life-time lubrication in permanently sealed bearings.

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- ☐ List of Class H motor repair shops.
- ☐ Data on Silicone Grease for motor bearings.
- ☐ 32-page booklet entitled "What's A Silicone?"

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Airless Rotoblast Barrel

Pangborn Corp., Hagerstown, Md., announces its new airless Rotoblast barrel designed to increase production and lower costs while maintaining high cleaning efficiency. Two sizes are available in the new line, 6 and 12 cu ft capacity. Others will be added later.

The new barrel, designated as Type GN, has several features aimed at improving cleaning operations while reducing abrasive loss. A newly designed work conveyer is driven by a hardened steel chain and uses special cast ductile iron slats which will not pinch the work. The conveyer slats turn on the pitch line of the sprockets and the distance between slats is always the same at any point in travel. This prevents passage of wire or chill nails into the track of the chain where operation could be affected.

Drive is by means of V-belts to a spur gear reducer mounted directly on the work conveyer shaft. When the barrel is operating, the conveyer travels upward to tumble the castings. After the cleaning operation, direction of the conveyer is reversed and the load is discharged into the work loader. Conveyer take-up is located on the bottom shaft where weight of the conveyer makes it easier to adjust. An automatic throw-out torque arm disengages barrel drive in case of jams. It works in both loading and unloading directions.

An abrasive-tight door and housing have been developed to retain abrasive within the machine and permit economical use of new types of abrasives. The door is woven wire mesh backed with vulcanized rubber and slides on rollers in a mechanized labyrinth. It rolls up compactly out of the way as it is opened permitting easy access to the cleaning chamber. A crank actuates the door and it can be held at any position by positive brake. It is expected that the rubber facing on the door will mean a considerable decrease in wear and maintenance.

During barrel operation, the cleaning and reclaiming system is constantly at work removing all sand and debris and maintaining the full efficiency of the abrasive. A rotary scalper wheel scalps off large fragments, leaving the abrasive which drop through a screen. Abrasive is conveyed up to the top of the machine to a seperator. At this point sand and spent abrasive are drawn out of the machine and good abrasive drops down to a storage container to be re-used. Volume of abrasive flow is controlled by an orifice plate.

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A quick-acting work loader, with double cables for safety, positively delivers the entire load into the machine. Control panel has been conveniently located alongside the cleaning chamber opening and push buttons are used.

Drive motor for the unit is $1^1/_2$ hp. The 6-cu ft unit is 6 ft 8 in. deep × 6 ft wide × 13 ft $9\ ^7/_8$ in. high. The 12-cu ft unit is 7 ft 9 in. deep × 9 ft 7 in. wide × 14 ft 6 in. high.

Clamshell Bucket Cutters

Of interest to operators of clamshell buckets in the excavating and heavy rehandling field is a new reversible and replaceable cutter recently announced by the Blaw-Knox Co. The new unit replaces the old type, one-piece tooth presently used.

Similar in principle to the two-part tooth used so successfully in drag-lines and trenchers the new tooth consists of a base which is permanently attached to the scoop, or lip, in the usual manner, and a reversible and renewable tip which fits into a slot and wedges itself into the base.

Replaced in a fraction of the time required to install old style teeth, the new unit not only reduces costly shut-down time but further effects savings by requiring only the replacement of that portion of the tooth which wears out.

Bases and cutters are available from stock for many Blaw-Knox buckets now in use and in addition blank bases (without drilling) can be applied to bucket sizes where the bolt hole patterns come within a range of the base outline. The adaptability to existing buckets can readily be determined by the factory from the serial number of the bucket.

Bulletin No. 2399 which fully describes this new accessory will be furnished upon writing to the Bucket Dept., Blaw-Knox Co., Farmers Bank Bldg., Pittsburgh 22, Pa.

Panel Instruments

Steadily increasing use of graphic panels and instrument consoles is further advanced by The Foxboro Co., 26 Neponset Ave., Foxboro, Mass., with the announcement of its new Consotrol line of compact indicators, recorders, and controllers. The Consotrol line comprises four distinct instruments, identified as Model 52, the forerunner of the series, and Models 53, 58, and 59, which may be used in a variety of combinations, depending on application requirements.

The Model 52 Consotrol controller features a 4-in. indicating scale and a continuous valve position indicator. It occupies only $3^1/_2 \times 6^1/_2$ in. of panel space, yet has all the operating characteristics of full-sized motion-balance units. Control point setting, auto-manual transfer switch, and a manual control knob are case-mounted for easy adjustment.

The Model 53 Consotrol recorder uses a full 4-in. strip chart to provide a 30-day process record on a single roll. Five hours of chart is visible without opening the case. A separate scale clearly indicates valve position and control set point. Over-all panel size is 6 × 6 in.

The Model 58 Consotrol controller is a new development in precision control, using a "floating disk" force-balance system which permits adjusting the proportional band from zero to infinity. Reset time is adjustable over a 1000:1 range.

The Model 59 Consotrol controller is mounted directly on the valve motor to control liquid flow, where orifice and control valve are in the same line, thereby reducing the lag between controller and valve. Fixed proportional, reset, and derivative values produce accurate control without adjustments.

Complete descriptions of these new Consotrol instruments are contained in bulletin No. 463.

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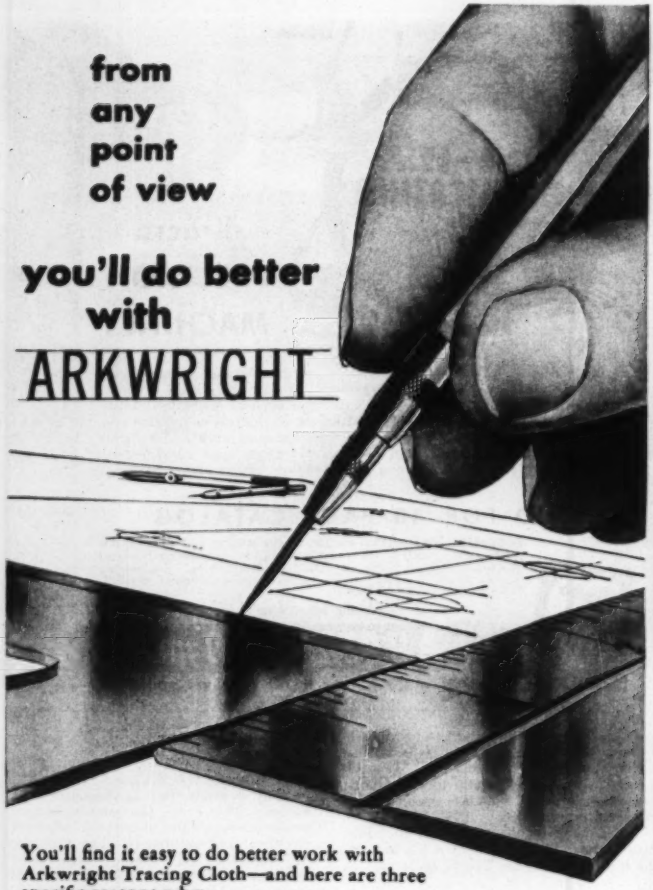

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Reversible Pump Turbine

Model tests of a reversible pump turbine being built by Allis-Chalmers Mfg. Co. for the U.S. Bureau of Reclamation's Flatiron power and pumping plant on the Colorado-Big Thompson project have been completed.

Tests on a scale model of the unit built in Allis-Chalmers hydraulic laboratory were witnessed by Ireal A. Winter, chief Hynraulic Machinery Branch of the Bureau of Reclamation, Denver, Colo.

The reversible pump turbine will be used primarily for irrigation and will pump water from the tail race of the Flatiron power plant into the project's Carter Lake reservoir. During periods when the pump turbine is not used for irrigation, it will operate as a turbine and supply peaking power to the electrical system in northern Colorado, Wyoming, and western Nebraska.

The reversible pump turbine is rated to pump 370 cfs of water at 240-ft dynamic head, and will be used over a range of head from 170 to 300 ft. When operated as a turbine, it will generate about 12,000 hp at 290-ft head and will operate over a range of head from 290 down to 140 ft.

The unit is unique in that it will operate at 300 rpm when pumping and 257 rpm when generating power and will have a motor to drive the pump which will also serve as a synchronous generator. It is scheduled to be placed in operation in 1953.

The Flatiron power and pumping plant is situated in the foothills of the Rocky Mountains about 11 miles southwest of Loveland, Colo.

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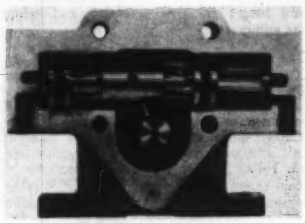
Power-Operated Valves

Ledeen Mfg. Co., announce the POV power-operated valve, available in six sizes, suitable for air, oil, and water operation with option of finger, cam, toe, or solenoid pilot controls.

Ledeen power-operated valves are designed to serve a variety of purposes where hand or foot-operated valves cannot be used, such as: Remote control, where the operation must be a distance from the valve; automatic operation, where the movement of some part of a mechanism must start the valve to create another movement; reciprocating service, where the cylinder must move continuously back and forth; safety, where a failure of electric power or line pressure must reverse the valve.



This power-operated valve is essentially a standard four-way valve, but the rotation of the disk is accomplished by means of a piston moved by the operating fluid pressure of the main line, and controlled by small pilot valves suitably located and actuated. Applying pressure through the pilot on one end of the piston forces it to move ahead and rotates the valve disk to forward position. Applying pressure on the opposite end moves the piston back and rotates the disk to reverse position.

Complete information including illustrations, operating and circuit diagrams, dimensions and weights, plus applicable pilot valves, are detailed in bulletin No. 1000 which will be sent upon request by writing Ledeen Mfg. Co., 1600 So. San Pedro St., Los Angeles 15, Calif.

Adjustable ConeJet Tip

A new compact spray nozzle tip has just been announced, for use with portable sprayers, that permits varying the spray from a solid stream to a finely atomized cone spray. This unit in named the adjustable ConeJet Tip, weighs only $1\frac{1}{2}$ oz, and fits the standard TeeJet spray nozzle body and the Trigger TeeJet.

Designed for spraying such liquids as insecticides, herbicides, and fungicides. Supplied in capacities, depending upon pressure, from 1 gal per hr to 112 gal per hr. Any setting to select spray desired is obtained by rotating the knurled body of the tip; only a half turn is needed for full range selection from solid stream to finely atomized cone spray. For complete information write Spraying Systems Co., 3265 Randolph St., Bellwood, Ill., for bulletin No. 63.

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NEW EQUIPMENT BUSINESS NOTES LATEST CATALOGS

Universal Dial Test Indicator

Advanced design of a new universal dial test indicator announced by Lufkin Rule Co., Saginaw, Mich., results in greater accuracy, durability, and adaptability. The indicator is so designed that it is lightweight, but very substantial. The one-piece construction of the base and shank results in an assembly that will not be loosened even under severe use. As the mechanism is mounted on the one-piece base and shank, a rigid and accurate alignment of the moving parts is provided which is independent of the case. The simplified mechanism excludes the customary train of gears, resulting in a smoother and more sensitive action. The jeweled thrust bearing also greatly increases the smoothness of operation and insures accuracy and longer life. All greasing and oiling are eliminated.

As the improved hole attachment screws directly into the base, no extra overhanging or supporting arms are necessary. The outside knurled ring (bezel) contains the dial and is adjustable so that the zero can be set to any position in relation to the pointer.

The lighter weight of the indicator makes unusually adaptable for use in connection with a height gage or a surface gage. As it is a universal and adjustable dial indicator, it is useful for determining surface flatness, alignment, out of roundness, relative heights, locations, and in many other checking functions.

The indicator is available in two models. A folder describing the models, attachments, applications, and prices will be sent on request.

Surface Pyrometer

Pyrometer Instrument Co., Bergenfield, N. J., has announced introduction of a new surface pyrometer for accurate surface and subsurface temperature measurements.

Called the new Pyro surface pyrometer, this instrument incorporates features not found in any other instruments of this type. The instrument is available with a selection of 14 different types of thermocouples and extension arms to meet every surface and subsurface temperature measuring problem. It can be equipped with a new quick-change connector which permits the thermocouples to be snapped and locked onto the extension

arms in a matter of a second, without any tightening needed. Thermocouples are interchangeabe without adjustment or recalibration.

Another exculsive feature of the surface pyrometer is the Pyro Lock-Swivel which permits locking thermocouples at any desired angle without danger of their jarring loose while the temperature measurement is being made.

Temperature readings can be taken readily from the large $4^3/_4$-in. direct-reading dial. In addition, the accuracy and precision of readings is assured because of the automatic cold end compensation feature of the instrument.

The surface pyrometer is shock, dust, and moisture-resistant and the shielded steel meter housing is designed to withstand rough usage. The Pyro surface pyrometer is available in five different temperature ranges for all laboratory and plant use.

Multistage Centrifugal Pumps

Ingersoll-Rand Co. announces that they have redesigned their line of horizontal, multistage centrifugal pumps for medium-pressure applications, incorporating modern hydraulics that give higher efficiency and better operation. These pumps, called the Class CNTA, are intended for boiler-feed, mine dewatering, marine, refinery, and general industrial services to 800 lb. Built in $1^1/_2$, 2, $2^1/_2$, and 3-in. sizes, units are available with 4, 6, or 8 stages

The Class CNTA pump features a horizontally split, smooth-bore cylindrical casing which contains the unit-type rotor assembly. This assembly is composed of the shaft, impellers, and channel rings, which contain the multiple-volute fluid passages. The entire rotor assembly is quickly and easily removed from and installed in the smooth-bore casing, since there are no mating ring fits or delicate alignment problems.

A completely balanced rotor is assured through modern, multiple-volute design, which eliminates radial thrust at all conditions of operation. Back-to-back grouping of the impellers neutralizes axial thrust developed by the pressure differential across each individual stage.

The same interstage sealing method successfully used in Ingersoll-Rand's higher pressure Class HMTA pumps is used in the CNTA line. This arrangement utilizes an alloy cast-iron or stainless-steel piston ring around the outer diameter of each individual channel ring. These hydraulic-type, step-seal rings have a metal-to-metal fit with the casing and are automatically placed under the correct compression when the casing halves are bolted together. They are highly resistant to corrosion and unaffected by high temperatures.

Ball bearings, ring oiled from their own reservoirs are standard, although sleeve bearings may be obtained if desired. Stuffing boxes may be packed solid or arranged for injection or circulation, as best fits the application. The Cameron Shaft-Seal may be installed in these pumps where difficult liquids are encountered. Water-cooled stuffing boxes are standard on pumps with steel casings and can be provided with cast-iron construction if requested.

Ingersoll-Rand has prepared a catalog sheet describing this pump line, which may be obtained by writing to the company at 11 Broadway, New York 4, N. Y., or to any of its branches throughout the world.

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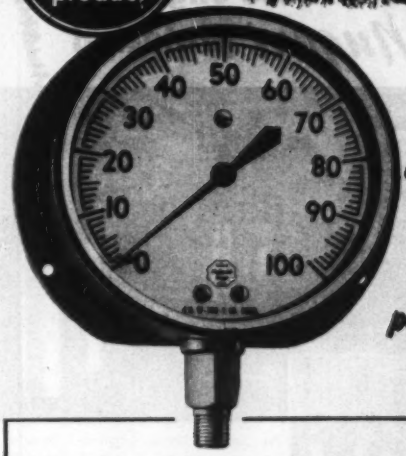

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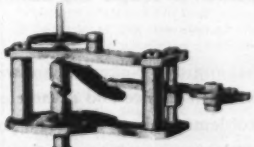
• Only HELICOID GAGES have the Helicoid Movement . . . tested and proved in years of hard service . . . a simple cam and roller design that does not have any teeth to wear out. Helicoid Gages cost less in the long run because they give long, trouble-free service with a minimum of maintenance.

Helicoid Gages can be furnished with ACALOY cases in flanged (illustrated), flangeless or flush mounting (round or square); also in phenol—with black, white or phosphorescent dials; phosphor bronze, alloy steel, stainless steel or K Monel Bourdon tubes; in pressure, vacuum or compound types; in a full range of pressures: all with the Helicoid stainless movement.



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can't get into these engines...
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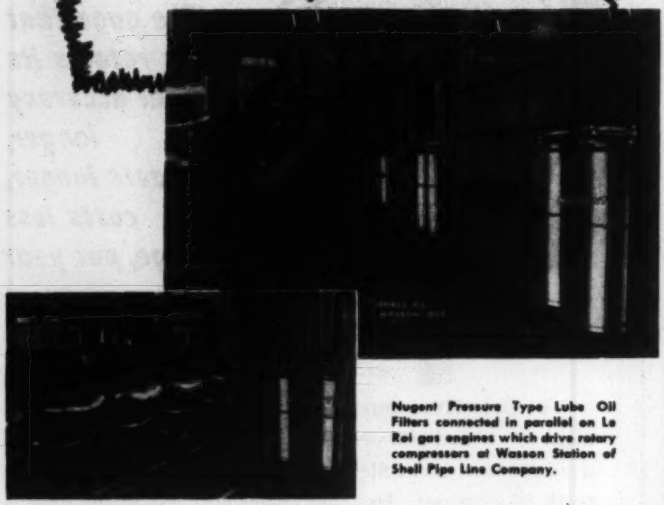

Nugent Pressure Type Lube Oil Filters connected in parallel on Le Roi gas engines which drive rotary compressors at Wasson Station of Shell Pipe Line Company.

THE lubricating oil used in these gas engines is always clean. Why? Because six Nugent pressure type lube oil filters are always on the job filtering out impurities. They remove 99.8% of the dirt, carbon and other foreign matter that gets into the oil permitting a constant flow of clean oil to all vital engine parts.

Filtering like this assures more efficient machinery operation. Nugent Filters, are designed to provide 20% more filtering area than any other filter of comparable size. They utilize inexpensive "Throway" recharges. Installation is simple and maintenance nil except for recharging.

For gas engines, compressors, diesel engines, Nugent filters will give you longer equipment life, less maintenance and greater oil savings. Tell us your filtering problems and we will send you full details on the Nugent filter that best suits your needs.

Wm. W. *Nugent* & Co., Inc.
407 N. Hermitage Ave. CHICAGO 22, ILLINOIS

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Reflash Steam Separator

Recovering the excess heat from reflash steam and putting it to work in low-pressure heating or process lines means real savings in plants that have large amounts of high-pressure condensate or continuous blowdown.

Central power stations, chemical plants, food process plants, oil refineries, paper mills, launderies, and many other types of industry can benefit from using a reflash steam separator developed by Strong, Carlisle & Hammond Co., Cleveland 13, Ohio.

The SC&H reflash steam separator, guaranteed to perform efficiently, is available in different sizes and is easily installed. The discharge line from high-pressure steam traps is run into the separator, which is (vented) connected into the low-pressure heating or process steam line. Water that remains after reflash steam is removed may be returned to the boiler for re-use, put through a heat exchanger, or exhausted. The separator can be used in high-pressure condensate and continuous blowdown systems.

Downflow Purifier

Reports indicate that dirt, moisture, riser discharge, and solids are removed before passing on to the distribution piping when an internal downflow purifier is installed in an auxiliary tank immediately above evaporators, packed towers, deodorizers, stills, bubble-cap towers, and inside steam drums, flash tanks, receivers, and other vessels. Called Internal Downflow Hi-eF Purifiers, they serve numerous functions, depending upon the application. They increase heating efficiency and protect pipe-line equipment in steam application. In chemical and petroleum vessels they recover valuable vapors. They increase production in evaporator operation, and in food processing produce a better product.

Hi-eF Purifiers carry a guarantee to the boiler industry to deliver vapor with 1.0 ppm or less of total solids. In other applications the purifier is guaranteed to remove 99% of all entrainment. A unique feature of these units is the separating element so designed that the units maintain a constant separating efficiency even as velocities become greater.

Removal of foreign matter is accomplished by means of a multistage centrifugal element which engages the entrainment laden vapor at the inlet at the top of the purifier as far away from the liquid level in the drum as possible. In three stages by means of carefully controlled centrifugal force practically all dirt, moisture, and riser discharges are removed. The cleaned stream is then passed on through the outlet of the vessel, while foreign matter is discharged to a drain. The design is such that there is no critical pressure drop through the unit.

Other advantages claimed by the manufacturer are low cost, (made possible by mass production methods and good design) no moving parts, which eliminates maintenance and self-cleaning action.

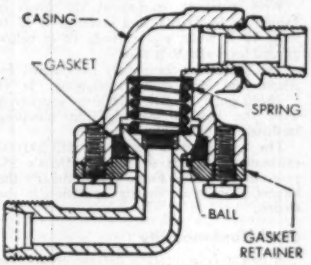
Although the unit described is designed for downflow service, upflow purifiers are available. Made in fabricated steel, stainless steel, or other alloy materials in outlet sizes 4 to 24 in. furnished with slip joint connections or can be threaded in sizes 4 through 10 in.

For further information write for bulletin No. 400, The V. D. Anderson Co., 1935 West 96 St., Cleveland 2, Ohio.

Hydraulic Swivel Joints

Development of a complete standardized line of high-pressure hydraulic swivel joints for general industrial, military, and aircraft use with tubing or pipe is announced by Barco Mfg. Co

The particular advantage of the design of the joints is that they are "self-aligning," which greatly simplifies and speeds up installation when working with tubing or pipe where it is difficult to attain perfect alignment. The self-aligning feature is also of prime importance in service as a result of eliminating binding and minimizing wear.



The joints are produced in four different styles with straight or angle connections for use with $^1/_4$, $^3/_8$, $^1/_2$, or $^3/_4$-in. tubing or equivalent size pipe. All styles and sizes are offered with a choice of thread connections: AN, Industrial Ermeto, or standard pipe threads. Pressure ratings are 3000 psi hydraulic with steel or aluminum casing and stainless-steel ball. Depending on service, temperatures ranging from −100 to + 500 F can be accommodated.

Principal uses for swivel joints of this type are in high-pressure hydraulic circuits where flexible "blowout-proof" all-metal lines are desired. The joints provide for 360 deg swivel action and have up to 15 deg side flexibility which permits movement in any direction. In other types of service, the joints may be used for handling air, steam, refrigrants, lubricants, or chemicals at extreme pressures and temperatures.

Detailed information on Barco high pressure hydraulic swivel Joints is contained in a new bulletin No. 269. Readers may obtain copies from Barco Mfg. Co., Dept. J-12, 1801 Winnemac Ave., Chicago 40, Ill.

15,000-Ton Forge Press

Top Air Force and Government personnel were on hand recently when Aluminum Co. of America unveiled a 15,000-ton forge press made in Germany during World War II and now in operation at Alcoa's Cleveland Works.

Built early in the war, the press was constructed by the Schloemann Co. of Dusseldorf for use in Germany's wartime light alloy industry.

The giant press, leased from the United States Air Force, will make it possible for Alcoa to produce large aluminum and magnesium forgings for aircraft faster and more economically than before.

The new press is the latest and largest addition to Alcoa's hydraulic press forging facilities. The company has had other hydraulic forge presses in operation for more than a decade.

Jet Aircraft Equipment Opens

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FOR many, many years Hamilton Standard propellers have been the most widely used item of aircraft equipment in the world. But with the advent of jet and turboprop engines, propellers are only one of many fields in which we use our modern facilities for research, design, development and manufacture.

Already we are setting the lead in the jet aircraft equipment field. This field presents a variety of fascinating challenges for the engineering mind.

To meet the new, and largest, research and development program in our 32 year history, we have just completed a 10 million dollar permanent plant in Windsor Locks, Connecticut—in the heart of beautiful New England.

Our new location offers excellent living and working conditions. It is near enough to major Eastern cities, sea and mountain resorts, to give you every cultural and recreational advantage. Yet it is rural enough to offer country-side comfort where you can work in peace and contentment.

We want men who would like to pioneer in new fields of endeavor—do *creative* engineering—enjoy freedom of decision and responsibility—and want to build a sound career with other young-minded men in an industry with a future.

Our employee benefits include group health, accident, hospitalization and life insurance, retirement income plan, paid vacations, and liberal sick leave policy. Our progressive program will provide ample opportunity for your future growth. *Actually, our technical engineering staff has continuously grown since the beginning of the Hamilton Standard organization.*

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WE NEED 97 EXPERIENCED ENGINEERS AND DESIGNERS

Design, development and test engineers with initiative and resourcefulness will find full opportunity at Hamilton Standard because of the newness of the jet equipment field itself. The company's extensive facilities—its staff of youthful, yet extremely high calibre men—its policy of recognizing talent and idea—its practice of quickly assigning responsibility—and its continuous habit of promoting from within—may well be the conditions you have in mind for a satisfying lifetime career.

Simply send your resumé to the Engineering Representative, Personnel Department, at the address listed below. It will be held in strictest confidence.

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DIVISION OF UNITED AIRCRAFT CORPORATION

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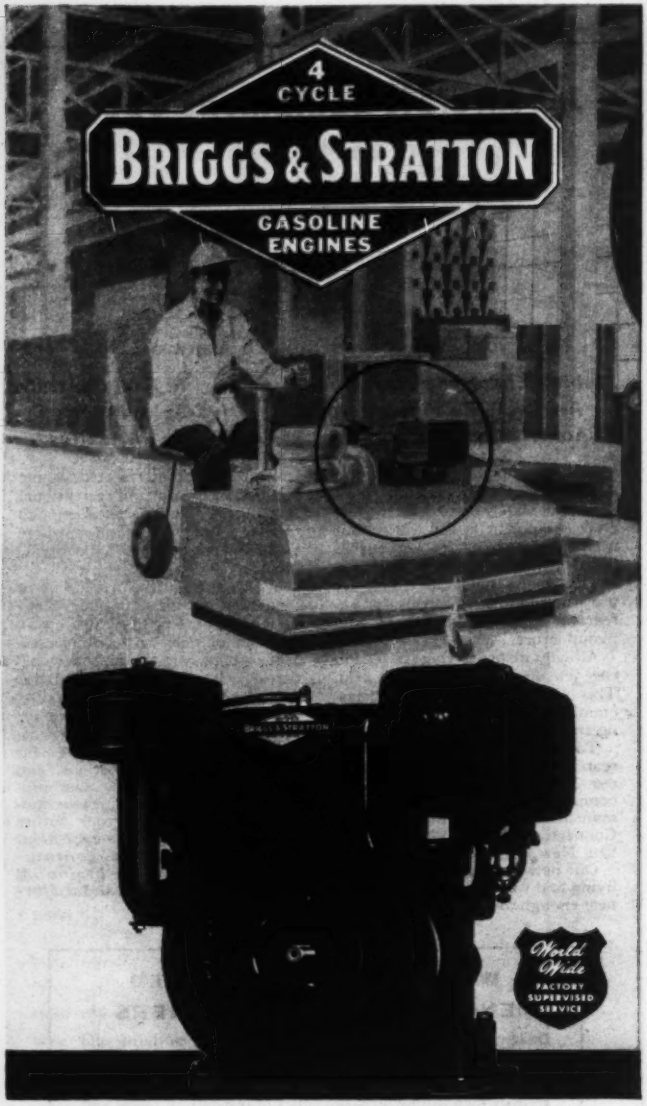


Preferred power on industrial power sweepers — the world's most widely used single-cylinder gasoline engines on hundreds of kinds and types of machines, tools, appliances used by industry, construction, railroads, oil-fields, and on equipment for farms and farm homes.

Time-tested, compact, powerful, reliable — Briggs & Stratton single-cylinder, 4-cycle, air-cooled gasoline engines are made by the world's largest builder of engines, and backed by the world's largest service organization of its kind. Briggs & Stratton Corporation, Milwaukee 1, Wisconsin, U.S.A.

In the automotive field Briggs & Stratton is the recognized leader and world's largest producer of locks, keys and related equipment.

To house the giant press, Alcoa erected an aluminum-clad building equivalent in height to a five-story structure. A special overhead crane was installed to lift parts weighing up to 120 tons as the press was being reassembled. The foundation required more than 1000 cu yd of concrete. The pouring proceeded continuously for more than 30 hr.

A huge double-headed die-sinking machine was installed to make the dies used by the press. In some instances a set of dies for the press will weight 25 tons. A total of 30,000,000 lb of pressure is exerted on the press die table which is 21 ft long and 7½ ft wide.

With auxiliary equipment the press is valued at $6,200,000 and installed is 22 ft long, 18 ft wide, and extends 18 ft below ground level and 36 ft above.

The press was completely overhauled by Alcoa and refinished throughout. It is a thoroughly modern machine supported with the best of heating and handling facilities.

The new press is part of a $13,200,000 expansion program to enlarge Alcoa's 35-year-old Cleveland Forge Plant, already the largest aluminum forging operation in the nation.

Steel Hardenability

A tool to help improve defense production has been made available, free of cost, to all American manufacturers of steel, United States Steel Corp. announced recently.

Research officials explained that the "tool" is not a "gadget," but a patented method for predicting in advance the hardening characteristics of steel compositions. As varying degrees of "hardenability" are indexes to the usefulness of steel for specific tasks, this knowledge will enable operating men to produce the types of steel that will exactly suit such diverse assignments as tough tank armor, strong struts for aircraft, brittle fragmentation bombs, or easily formable cases for shells.

Conversely, the patented method makes possible the design of steels of required hardening characteristics from the available supply of steel making materials. Since many alloying elements normally used for special steels are now in short supply and others would be short if war blocked world sea lanes, the new method will be of great assistance in making maximum use of existing supplies of traditional elements or of other elements that may be substituted to give approximately the same service.

Patent was issued July 3, 1951, in the name of Marcus A. Grossmann, and assigned to United States Steel Co., where Dr. Grossmann is adviser in research planning. The patent was recently dedicated to the public by U. S. Steel. This action makes it available to all interested parties.

The "hardenability" of a steel, Dr. Grossmann asserted, is measured as the depth from the surface to which a given steel composition hardens when quenched. Steel men have known for many years that hardenability in general depends on the chemical composition of a steel—the quantities of various ingredients, such as carbon, manganese, molybdenum, chromium, nickel, and others, that are added to iron to make different kinds of steel. By careful experiments and tests of his results, Dr. Grossmann was able to assign definite hardenability values to these elements. By now great tonnages of steel have proved the validity of his findings.

Westinghouse Completes Sound Laboratory

A "point of no return" for echoes has been built into a new sound laboratory by Westinghouse Electric Corp. More precisely called an anechoic chamber, the room will enable research engineers to study noise—its source, cause, and measurement.

The laboratory is located in a suburban area of Pittsburgh, Pa., where the surrounding noise level is quite low. Inside the main building and surrounded by masonry walls 12 in. thick, a 19 × 13 × 10-ft room has had its walls, roof, and floor completely covered with insulating material shaped in the form of wedges. These wedges are the heart of the anechoic chamber for it is their shape, composition, size, and number that determines the efficiency of the room. Fabricated from glass wool, each wedge is 8 × 24 in. at its base and 34 in. long. Wire mesh with ½-in. openings encases each wedge to facilitate installation and protect the easily damaged filler.

A spring-supported wire net is stretched from all four side walls several feet above the wedges which cover the floor of the chamber. This working platform will support equipment to be tested. Overhead, necessary types of service lines are available to operate the various test pieces. Since only the noise source plus a microphone pickup will be inside the room during test runs, all gages and recording devices are located on control panels in an adjoining room.

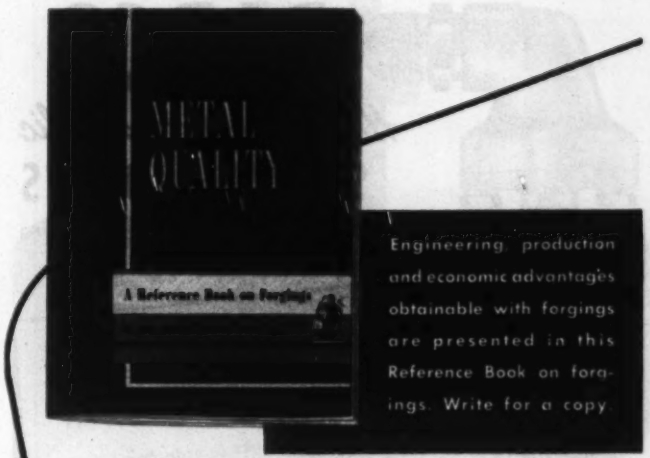
In a so-called "free sound field," such as would exist at an altitude of 50 or 100 miles, sound waves would emanate from a source in all directions and their intensity would decrease as the inverse square of the distance from the source. This would, of course, preclude the presence of any kind or magnitude of background noise. Since there would be no surrounding walls or obstacles in this "free field," no reflections of sound would occur—hence no echoes. These are the physical factors that Westinghouse engineers have endeavored to build into their anechoic chamber.

The quiet site location of the lab and the type of wall construction have produced a depressed ambient sound level. The design of the wedges themselves absorbs and prevents reflection of sound waves. A sound level within the room of 10 to 15 db is anticipated. In comparison, a residential neighborhood at night has a noise level of 25 to 30 db.

One of the problems that will be studied in the new sound laboratory will be that of determining a standard method of measuring noise. Although certain limits of sound emanation for each type of electrical equipment are specified by the National Electrical Manufacturers Association, the method of measuring noise throughout industry varies widely. This has led to confusion and in some cases rather large unnecessary expenditures.

Other investigations will lead to sound reduction in many types of Westinghouse equipment including ballasts in fluorescent lighting fixtures, transformers, refrigerators, vacuum cleaners, air conditioning units, speakers for home radios, and jet engine test cells.

It was emphasized that the sound study program will not be a rapid one with solutions to present noise problems as their immediate goal.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A Reference Book on Forgings
Engineering, production and economic advantages obtainable with forgings are presented in this Reference Book on forgings. Write for a copy.

FORGINGS ARE UNUSUALLY EFFECTIVE FOR SOLVING PROBLEM PART PROBLEMS

A problem part problem, however complex, often ceases to be a problem once all the aspects of the part are checked with the unrivaled economic and mechanical advantages of closed die forgings and the closed die forging process for producing parts. Whatever the nature of problems that make a problem part, consult a forging engineer to determine the extent to which forgings can help you solve them.

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Please send 60-page booklet entitled "Metal Quality—How Hot Working Improves Properties of Metal", 1949 Edition.

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High Pressure Hydraulic SWIVEL JOINTS

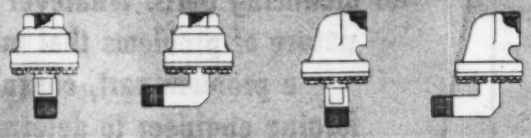
For ¼", ⅜", ½", and ⅝" O.D. Tubing or comparable pipe sizes

THERE is no question about *performance* when you use Barco Swivel Joints designed for 3,000 psi hydraulic operating pressures. Barco's *exclusive* design gives you these important advantages:

- **NO BINDING!** Thanks to *side flexibility*, combined with 360° swivel (rotating) action.
- **SELF-ALIGNING!** Speeds up and simplifies installation. Guards against wear.
- **LEAKPROOF!** Precision machined and ground ball seats perfectly at any angle on flexible seal.
- **EASY TURNING!** Moves freely even when fully pressure loaded.
- **ABSORBS VIBRATION!** No metal-to-metal contact through joint. Moves in any direction.
- **CORROSION RESISTANT!** Offered with materials suitable for corrosive service.

Designed to meet the most critical aircraft and ordnance requirements, Barco High Pressure Hydraulic Swivel Joints are available in a complete range of standard and specially designed styles and sizes for INDUSTRIAL APPLICATIONS. *Barco Engineers are at your service; ask for information.*

STANDARD STYLES—Steel or Aluminum Casing with Stainless Steel Ball



Connections: AN, Industrial Ermeto, or Standard Pipe Threads

Send for Bulletin 269 ➡

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The Only Truly Complete Line of Flexible, Swivel, and Revolving Joints

FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

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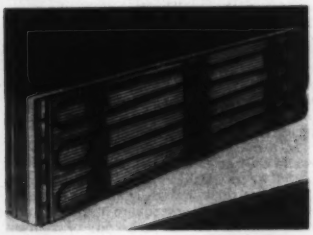
Infrared Oven Panels

New pre-engineered electric infrared oven panels have been announced by Edwin L. Wiegand Co. The panels—in two modular sizes with built-in bus bars, insulation and frame—arrive on the job complete, ready to be erected in oven structures, and connected to plant wiring. The simplicity of the panels meets the need for ovens that can be built quickly, easily, and economically. Depending on size and shape, complete ovens can be erected in several hours, ready to go to work.

Energy radiated by this far-infrared generator is absorbed with practically equal speed by all colors from black to white, with negligible reflection. Even clear glass and plastics, which transmite near-infrared, absorb this far-infrared radiation. "Far-infrared" is a technical name for the longer wave length of radiation—which is far from the visible portion of the spectrum and is therefore barely visible. This absorption-efficiency advantage results in rapid heating, bringing work to temperature quickly, reducing oven and conveyer lengths.



The infrared output of the panel is considerably higher per square foot than any other infrared equipment operating in this temperature range. Ideal for work which requires crowding heat in a limited space, as with conveyerized degreasing, the intense radiation can also be "dialed"—from 4 to 100% of capacity—for accurately selecting and maintaining work temperatures up to 700 F. Once the heat requirements are determined, the inexpensive controller dial setting can be "logged" and the far-infrared heat output duplicated exactly at any time. Experience shows that long service life can be expected from the totally enclosed, alloy-sheathed heating elements.

Two sizes of Chromalox Radiant Panels are available: 1 × 4 ft, with a capacity of 10.8 kw—and the 2 × 4 ft panel with 21.6 kw capacity. Output of panels is in excess of 9200 Btu per sq ft per hr. These two modular sizes can be assembled into ovens of almost any length, width, or height. They can also be rearranged to fit new work size—or readily moved to various locations.

For more information write Edwin L. Wiegand Co., 7646 Thomas Blvd., Pittsburgh 8, Pa. Ask for bulletin No. CS-605.

Turbine Vane-Type Pump

For pumping hot and cold, clear and vaporous liquid, in moderate capacities, against medium or high heads, Peerless Pump Div., Food Machinery and Chemical Corp. has recently introduced a complete line of self-priming and standard design turbine vane-type pumps.

Keep Informed

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

The designation Type TVE is given to the line of pumps close-coupled to face mount electric motors; the designation Type TVB is given to the line of flexible-coupled electric drive pumps. Pumps in both lines are available with or without the self-priming device.

The principle of operation on which these pumps are constructed is very simple. In the turbine vane-type pump, liquid enters the suction inlet, passes through suction ports, and is picked up by a single multivaned impeller. As the vanes, rotating at nominal speed, pick up the liquid the centrifugal force imparted by the vanes throws the liquid into the channel from which the liquid is deflected into succeeding vanes of the impeller. This is called a regenerative action and it continues around the channel, continually building up pressure until the liquid reaches the stop which deflects the liquid into the discharge outlet. A result of this regenerative action is the simplified pumping of light or vaporous liquids. Applied to boiler feed service or condensate return service, hot water up to 250 F can be handled. An additional feature of this type of pumping action is the ability of the pump to handle liquids where a constant capacity is required, but where head conditions will vary. In all cases the liquid must be clear without solids in suspension as their presence quickly destroys the close-running clearance upon which the vane type impeller relies for optimum operation.

There is only one moving pump part in this pump, the free running impeller. Because side and top suction are employed in the case design, disassembly of the liquid end for inspection and repair is simple and easy and may be accomplished without breaking suction or discharge piping.

The self-priming device consists of a trap on the suction and an air-separating chamber on the discharge. These insure liquid in the pump case at all times, which is necessary for self-priming. The suction trap includes a strainer for further protection to the pump.

Standard construction materials for handling clear water is with cast-iron case, bronze impeller and liners, stainless-steel shaft, and a standard mechanical shaft seal. Cover liner, impeller, and inner liner are all replaceable.

Capacity range at 3500 rpm is up to 58 gpm; at 1750 rpm, up to 56 gpm. Head range at 3500 rpm is up to 800 ft; at 1750 rpm, up to 300 ft. Motor sizes up to 20 hp are available at 3450 rpm and up to 7½ hp at 1750 rpm.

Complete descriptions and illustrations of these turbine vane-type pumps together with head-capacity selection charts, sectional views, and elevation drawings and dimensions are included in a new bulletin which

For Safer, Surer Supervision
of boiler water levels--
Reliance Water Columns
and Complete Gage Equipment
Forged steel strength for exceeding code requirements—Reliance Columns for pressures to 2000 lbs.; with alarms, to 900 lbs.
Precision-made gage inserts for all pressures. (Mica-protected flat glass or all-mica windows.) Sizes for all visibility lengths.
Latest developments in gage valves, gage cocks, gage illumination; auxiliary alarm devices. Write for full information.
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The name that introduced safety water columns....in 1884
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BOILER SAFETY DEVICES

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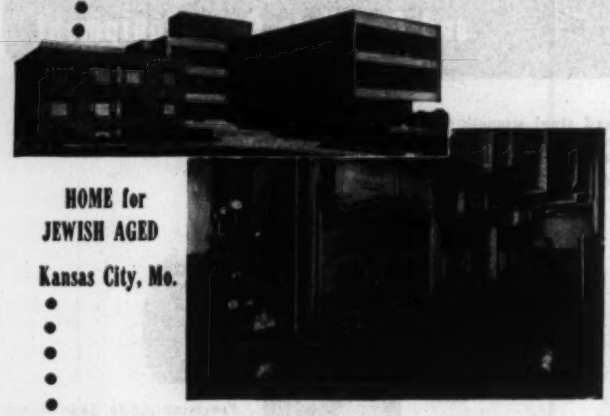
KEWANEE

HEAVY-DUTY STEEL BOILERS



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Three Kewanee Heavy-Duty Oil-Fired Boilers installed by

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In planning institutional buildings today . . . careful consideration must often be given to later expansion of *both* building and equipment facilities.

Kewanee Boilers are capable of producing *more steam* than is guaranteed by their rated capacities, hence are ideally adapted when later expansion is needed. This fact plus a well known dependability and economy of fuel makes Kewanee the logical selection for important buildings of every type.

KEWANEE-ROSS CORPORATION
Division of American Radiator & Standard Sanitary Corporation
KEWANEE, ILLINOIS

may be obtained by writing the manufacturer, Peerless Pump Div., Food Machinery and Chemical Corp., 301 West Ave. 26, Los Angeles 31, Calif., and requesting bulletin No. B-2205.

Intrimik

The Intrimik announced by Brown & Sharpe Mfg. Co, Providence, R. I., provides in a novel way exclusive advantages for measuring bores and holes. This handy precision instrument takes inside measurements directly in increments of 0.0001 in. from 0.275 in. to 0.500 in. or 0.0002 in. from 0.500 in. to 4.000 in. and it does this positively, easily, and quickly at depths of 2 in. in the three smaller sizes and 3 in. in larger sizes.

By means of an extension, furnished as an extra, measurements are made directly at depths up to 6 in. with three smaller sizes, and at depths up to 9 in. with larger tools, a distinct advantage for measurement in deep bores. For measurements at greater depths two extensions may be used, permitting measurements at depths of 10 in. and 15 in.

A unique design incorporates three measuring points, making the tool extremely sensitive to the true measurement of the bore or hole. These three measuring points make line contacts with the surface of the bore or hole so that the instrument aligns itself accurately both axially and radially.

Revolutionary in principle, Intrimik utilizes a hardened precision screw, generated and ground on an accurate colnic spiral turning integrally with the rotating micrometer thimble. Measurements are read similarly to those made with a conventional micrometer.

Where bore or hole sizes must be determined accurately or where measurements must be taken over a range of sizes, Intrimik offers tremendous savings over the cost of the many plug gages necessary to establish tolerances and provides advantages and economies in machine work through exact measurements not possible with gages of fixed dimensions. An important advantage of Intrimik is its elimination of the many expensive setting rings required for comparator type gages and the attendant saving of their high cost.

Furnished in dull chrome with black graduations for easy reading. Measuring surfaces are high carbon, high chromium, rust and wear resistant steel. Simple means are incorporated in tool to compensate for wear of measuring surfaces and for setting instrument to exact calibration with a standard ring. A single setting ring serves an individual tool or two tools when furnished in sets.

Brazing Alloy

A new copper-phosphorus-silver alloy, Phos-Silver®, for efficient brazing of copper, brass and bronze is available from the Westinghouse Electric Corp. Extreme fluidity and good wetting properties enable this new alloy to penetrate tight-fitting joints instantly to form strong ductile bonds.

Phos-Silver® can be used with any of the common brazing methods for brazing on copper alloys, and is ideally suited for applications where brazing temperatures are critical. On heavy sections that absorb large quantities of heat, its low brazing temperature (1225 to 1275 F) substantially reduces brazing time. On fine work or low melting brass, where there is danger of over-heating, it provides an extra margin of safety. No flux is needed in copper-to-copper brazing.

Typical Phos-Silver® uses are found in the assembly of refrigerating and air-conditioning equipment, motors and transformers, and heat exchangers and plumbing installations.

For further information, write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.

Vacuum Gage

A new DPI Phillips Gage, Type PHG-09, which covers a range of 8,000,000:1 on a single meter from a single pick-up has been announced by the Distillation Products Industries division of the Eastman Kodak Co.

This new gage, the company said, can be used to read vaccums from 0.50 mm to 10^{-7} mm Hg. The all-metal pick-up tube which handles this range works on the glow discharge principle. In the tube, permanent magnets provide a field which lengthens the electron paths into tight spirals that give high ionization per electron, with a cascade effect.

Having no filament to burn out, the new tube can be operated at full atmosphere without damage. In addition, the circuit is insensitive to fluctuations in line voltage.

Another advantage of the new gage is that because the magnets are external to the ionization chamber, there is no problem involved with outgassing the magnets or removing stray iron particles. Furthermore the tube is automatically self-cleaning because when operated at the higher pressures in the lowest sensitivity range, it rids itself of deposited film.

Further information about the DPI Phillips Gage, Type PHG-09, may be obtained by writing to Vacuum Equipment Dept., Distillation Products Industries, Ridge Road West, Rochester 3, N. Y.

Special Roller Chain

Climaxing four years of research and development, the Whitney Chain Co. of Hartford, Conn. has now introduced a special roller chain incorporating oil-impregnated sintered metal bushings.

Roller chain, has for decades been recognized as one of the most efficient and versatile means of mechanical power transmission available to machine designers and production men. Up to now, however, the use of roller chain has been limited under certain conditions, due to the need for either externally applied lubrication or totally enclosed lubrication.

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because DoALL uses the PROFILOMETER

The DoALL Company of Des Plaines, Illinois, world famous manufacturer of machine tools, gages and cutting tools, gives customers an exclusive analysis of the precision and dependability of each DoALL Precision Surface Grinder.

To do this, DoALL relies on the Profilometer as the final check made on every grinder manufactured.

Rigid tests provide that each DoALL grinder before completion must grind a sample block of steel using a standard 46-grit wheel and have the resulting surface finish measured by the Profilometer. This Profilometer test on the steel block must register a finish of less than 10 microinches r.m.s.! These records of surface finish with the actual steel block are then attached to each grinder prior to shipment—thus assuring purchasers of the exceptional precision of each grinder.

As a shop instrument the Profilometer is widely being used throughout all industry where surface measurement is needed in machining, grinding or other sizing and finishing operations.

The Profilometer provides the fastest, simplest and most versatile means of obtaining dependable roughness ratings for all surfaces from a fraction of a microinch to 1000 microinches r.m.s.

In your plant, too, the Profilometer can offer exceptional advantages as an all important shop tool.

To learn how the Profilometer can help cut costs in your production, write today for these free bulletins.

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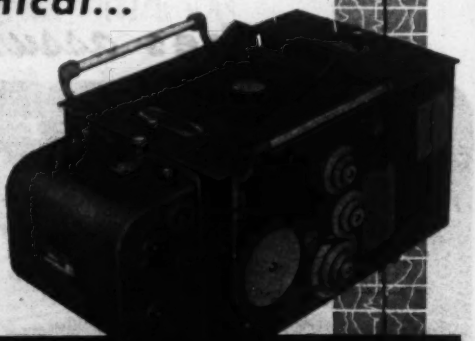

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The new Whitney oil-impregnated sintered bushing chain, requiring little or no lubrication, was designed to satisfy this recognized need for a chain drive which would operate efficiently where conventional lubrication methods are either not possible or desirable.

Exhaustive laboratory tests and field installations of the new sintered bushing chain indicates a marked increase in service life on applications where normal lubrication is not available, according to the manufacturer. An insight into the possibilities of the new chain can be gained by the findings of a recent laboratory test. In this test, a $^3/_8$-in-pitch oil-impregnated sintered bushing chain and a $^3/_8$-in-pitch standard roller chain, prelubricated to the best practice were installed on 19 tooth and 45 tooth sprockets having a center distance of 8.75 in.

The two chains were then run under a 10-hp load at 1900 rpm. This test is comparable to that of a motorcycle chain operating at 80 mph, using full engine horsepower.

At the end of 20 hr operation, the standard, prelubricated roller chain showed wear or elongation of 0.380 in. The oil-impregnated sintered bushing chain showed a wear or elongation of but 0.080 in., indicating an increase of several hundred per cent in anticipated service life. A chain, possessing such marked advantages is expected to open up new fields of use for roller chains in areas restricted previously to other methods of power transmission. For example, the textile industry has, wherever possible, avoided the use of drives requiring external lubrication, due to the possibility of damaging the fibers or finished textiles by oil spotting.

In other instances, chain drives are employed frequently in areas containing considerable grit or abrasive material. Under such conditions, chain drives are often operated without lubrication of any sort, as external oiling of the drive results in a materially decreased service life.

There are obviously, many applications in other industries requiring a chain that requires little if any lubrication due to other conditions. Application of the new-oil-impregnated sintered bushing chain will be subject to engineering approval by the Whitney Chain Co. Whitney Chain will gladly entertain requests for further information regarding this new product. For the time being, production of the new sintered bushing chain will be limited and restricted to several sizes.

Studio T-V Monitor

A new 17-in. Du Mont television studio monitor featuring brighter, sharper picture reproduction is now being offered by Television Division of the Allen B. Du Mont Laboratories, Inc., Clifton, N. J. The new Monitor incorporates many features not found in previous monitor designs.

The Monitor employs a 17-in. rectangular aluminized gray-faced tube allowing the largest picture possible for standard 19-in. RTMA rack-mounting. The size of the picture is controlled from the front panel so that picture may be reduced for close viewing. Linearity is constant with changes in picture size. Regulated pulse-type high-voltage supply on monitor chassis provides 17,000 volts at 250 microamps for extremely bright and clear reproductions. Brightness is of the order of 100 foot lamberts. Full contrast is obtained with only 0.25 volts peak-to-peak video input.

An anastigmatic yoke produces excellent over-all focus to all four corners of the picture. Line voltage changes have no effect on the focus. Focus is stabilized at all times, requiring no attention.

Video bandwidth is 10 mc (within 3 db) for accurate monitoring of high resolution signals without overshoot or smear. Video signal is clamped on back porch to eliminate brightness variation with picture content.

The new Du Mont Monitor also provides pulse cross sweeps at the turn of a front panel switch. This provides a quick, accurate check of sync signal, front and back porch width, sync width, equalizing and serrated pulse count. Unit operates on composite video or separate video and sync.

The unit mounts in a standard RTMA 19-in. rack, using 17½ in. of vertica space. A separate regulated power supply (standard Du Mont Type 5019-A) is used to eliminate changes in picture size due to line voltage fluctuation. Weight is approximately 50 lb. Necessary cable and accessories are included.

Carbide Shear Blocks

Successful use of shear blocks of Carboloy cemented carbide for trimming of flash from steel castings in production is reported by Oliver Corp. of Shelbyville, Ill.

The shear blades are used on a progressive die in a crank press in which mower blade guards are respectively pierced, riveted, and trimmed.

The shear die originally had to steel trim blocks, one on each side of the die, to simultaneously shear six faces varying in length from ¼ to ⅝ in., three on each side of a SAE 1045 casting.

Tool life of the trim blocks, relative to the other tools in the progressive die, was comparatively short and they had to be changed at the end of each day (12,000 pieces). The use of Carboloy cemented carbide made by Carboloy Dept., of General Electric Co., Detroit 32, Mich., on the cutting edges of the trim blocks proved to be the answer to the problem.

The original trim blocks were altered to receive the inserts by grinding a step in each and the inserts, of Carboloy Grade 55A tungsten carbide, were then brazed on the steps at intervals along each block to correspond with the casting faces to be sheared.

The blow is taken on the ¼-in. face of the inserts and because the parts are not stripped, there is a 1/64-in. over-hang of the carbide to provide free clearance to facilitate removing the part before the die head moves back to the top. No difficulty has been encountered from this supported over-hang.

With the carbide blocks tool life of the shearing die has been increased to well over 100,000 pieces between grinds. Very little grinding is needed at the time of sharpening and there has been no sign of the cutting edges being chipped or broken under the continuous impacts.

Self-Contained Air Conditioner

A new compact 7½-ton-capacity self-contained air conditioner for cooling space such as average size retail stores or general offices, has been introduced by Frigidaire Div. of General Motors, Dayton, Ohio.

The new unit has the same attractive Raymond Loewy design and styling as the 3 and 5-ton models in Frigidaire's self-contained air conditioner line. In spite of its

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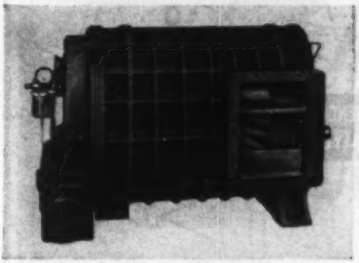
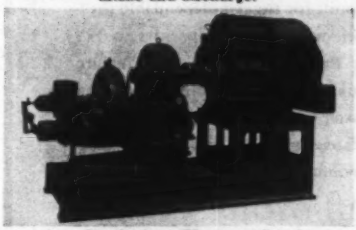
ADAPTABILITY



Standardaire Blower with side intake and discharge.



Standardaire Blower with turbine and gear drive unit.

Standardaire Blower with side intake and end discharge.

To meet the specific needs for industry, Standardaire's unique design provides for maximum flexibility in meeting unusual requirements for intake and discharge connections. For example, the blower intake or discharge ports can be located on the end, top, bottom or sides···· two intake or discharge ports may also be provided when necessary. These exclusive features, plus provisions for direct drive by a power unit of your choice, are typical examples of Standardaire's adaptability.

Standardaire Blower with single top intake and two side discharge ports.

Installation showing three Standardaire Blowers.

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New capacity for high volume circuits! The new two-inch HydrOILic Relief Valve is built for rugged, dependable pressure control up to 5000 psi, with volume capacities to 125 gpm. Like all HydrOILic Pressure Controls, they feature exceptionally low differential between opening and closing pressures — resulting in faster action . . . closer control of pressures . . . reduction of over-pressure and pressure-drop conditions. Subplate type mounting for high pressure circuits. Write for complete data.

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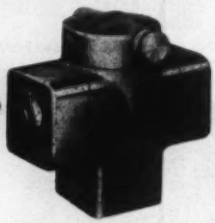

Now . . . *Denison quality* in a bigger-than-ever line of oil-hydraulic pressure controls! HydrOILic Reducing Valves provide independently adjustable pressures for secondary circuits, while main circuit operates at either constant or fluctuating higher pressures. Available in ¾", 1¼" and 1½" sizes, they permit secondary circuit volumes up to 65 gpm. Threaded, flange, or subplate mounting. Write for data.

Get *Denison* quality for all oil-hydraulic circuit needs. Specify HydrOILic Valves, Pumps, Fluid Motors, Pumping Units, Surge-Damping Controls, and the dual-purpose vane-type Pump/Motor featuring *complete radial balance* — for every circuit need. Write today!

The DENISON Engineering Co.

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high capacity, the over-all package is only about as large as the average 5-ton unit. It is only 40 in. wide, 28 in. deep, 86⅜ in. high, and is finished in harmonizing two-tone gray. The unit delivers 2700 cfm of conditioned air and has an air throw of 75 ft.

Installation and operation of the unit is simple. The complete mechanism is located within the compact cabinet. Electrical, water, and drain connections are all that are necessary. The simple controls are located behind a small access panel on the front of the cabinet. A simple "On-Off" switch allows the user to manually control the unit, but the unit is designed to provide fully automatic room temperatures by a control knob which is set for the temperature desired.

The inside of the cabinet is divided into three sections; the compressor section, the cooling coil or air intake section, and the air discharge section.

The 7½-hp compressor is located in the bottom of the cabinet and is a new revolutionary Frigidaire sealed reciprocating-type with direct drive operation. It has no external moving parts such as belts, pulleys, and flywheels, yet is constructed so that the motor and other parts are easily accessible.

The coil section houses the big Frigidaire multipath cooling unit which is constructed with ⅜-in. copper refrigerant tubing, 5 rows deep and 18 rows high with circular aluminum cooling fins. Placed across the front of the cooling unit is a permanent-type, cleanable aluminum mesh air filter which cleanses all the air passing through the cooling unit.

The air discharge section contains two large double-inlet, double-width, wheel-type fans powered by a ⅓-hp electric motor. These fans discharge the cooled air into the hood on top of the cabinet, and on out into the space to be conditioned. Adjustable grilles on all four sides may be set to deliver the cool air wherever desired.

The unit can be installed remotely with ductwork if desired. In this way it can furnish air for several different individual rooms. Outside air can be brought into the unit by the installation of a low resistance duct connected to a grilled opening in the rear of the cabinet.

A two-row steam heat coil for heating pusposes is available as accessory equipment.

Airfoil Centrifugal Fan

A new type nonoverloading, centrifugal fan that is over 90% efficient with only ⅓ of the noise intensity of previous models is available from the Sturtevant Div. of the Westinghouse Electric Corp., 200 Readville St., Hyde Park, Boston 36, Mass.

Designed especially for industry, power, and commercial building needs, the new fan ranges in wheel sizes from 40¼ in. to 108 ⅜ in. in diam and is capable of delivering volumes of up to 600,000 cfm.

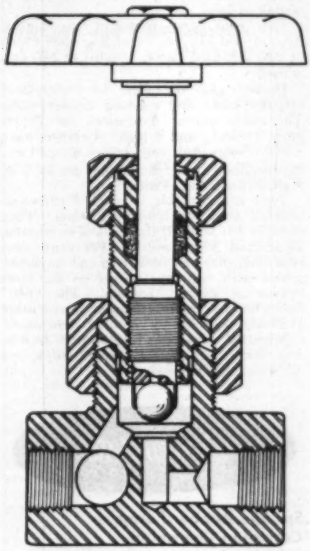
The new airfoil blade design, along with simultaneous aerodynamic changes in inlet and casing, has boosted mechanical efficiency at peak to 92%, and increase of 8% over current designs. There has also been a reduction of five decibels in the noise intensity level.

Said to be the most efficient centrifugal fan available today, it is recommended wherever high efficiency and low sound level are prime considerations, and, hence, the higher initial cost can be justified by an evaluation of lower operating costs.

Ball Valve

A new 1/4-in. ball valve of unique construction, recommended for working pressures up to 3000 psi, is announced by The Foxboro Co., Foxboro, Mass. Descriptive details will be sent on request.

Tight, positive, shutoff is provided by a stainless-steel ball which closes into a machined, conical seat. The ball, retained at the end of the stem, is free-rolling so that every closing brings a new surface into contact with the valve seat. Alignment of ball to seat is accurately piloted by a forged-steel, union-type bonnet, fitting tightly to the body and assuring a correct valve closure.



The long-stroke stem and the packing gland are made of stainless steel for durability and resistance to corrosion. The packing is a preformed, graphited asbestos with a plastic binder and can easily be replaced without shutting off the line pressure or interrupting the process. Straight-through and angle types are available with two and four connections, meeting the wide range of valve-design requirements found in general industrial use, as well as in pilot plants and laboratories.

Especially useful on meter manifolds, gage lines, seal chambers, bleed-off connections, sampling connections and lubricator shutoffs, the Foxboro ball valve is universally adaptable in applications for liquid gas, and steam service.

Unit Work Benches

Work benches, whose standard units can be tailored to fit space and other needs and whose big storage facilities permit uncluttered working tops, have been developed by the Standard Pressed Steel Co., Box 558, Jenkintown, Pa.

The latest addition to the SPS Hallowell line of shop equipment, the new work benches,

this
HELI-COIL®
insert
will give you
positive protection against wear, stripping and corrosion in all tapped threads. It permits cleaner, more functional product design... it may save you many a sleepless night. Why not look into it?
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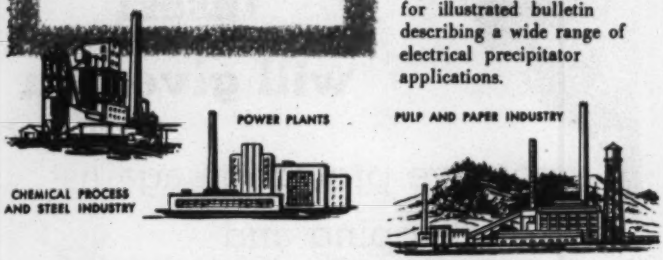

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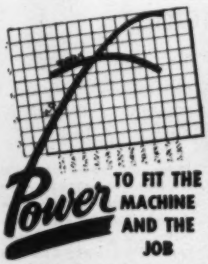

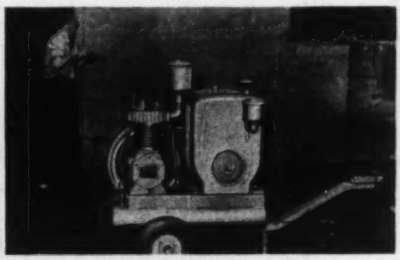

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Gardner-Denver Compressor

4-cycle Single Cyl. 3 to 9 hp.

4-cycle 2-Cyl. 7 to 13 hp.

V-type 4-Cyl. 15 to 30 hp.

This Model TP04931LE Portable Compressor, made by Gardner-Denver Co., Quincy, Ill., is supplying air for the operation of a Model S17 Utility Drill, engaged in a plant maintenance job. Complete power reliance is placed on the Model TF 2-cylinder Wisconsin Heavy-Duty Air-Cooled Engine.

More and more builders of engine-driven equipment are discovering, to the satisfaction of themselves and their customers, that you can't do better than to specify "Wisconsin Engines"... for dependable power to fit both the machine and the job.

Available in a complete power range from 3 to 30 hp., in 4-cycle single cylinder, 2-cylinder and V-type 4-cylinder models, Wisconsin Air-Cooled Engines provide economical power, without waste, to meet the most exacting requirements. Look into them for your use.

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identified as the "640" Series Unit Work Benches, can be used as continuous benching or as single work stations.

The new benches come in three basic models. Model 640 is made up of a top, two pedestals—one a drawer unit and the other a cabinet unit—and two bases. Model 643 includes a top, two drawer units, and two bases. And 646 is assembled with top, two cabinet units, and two bases.

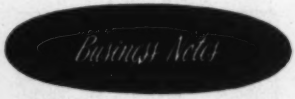
SPS pointed out that the drawer unit, containing four drawers, and the cabinet with shelf permit workers to store materials, tools, and records which customarily clutter the working top of a bench. Stored, such items are kept clean and out of the way but readily at hand.

The "640" Series comes in two heights, 31¼ in. and 33½ in., depending upon which of two standard bases, 4½ in. or 6¾ in., is used.

Drawers glide on rollers, have individual cylinder locks and recessed drawer pulls. The inside drawer dimensions are 20 in. deep, 14 wide, and 5 high. Cabinets have an adjustable shelf and chrome-plated locking handles. Inside dimensions are 20⅛ in. high, 20 deep, and 14 wide.

Tops are available in steel, Preedwood-covered steel, or laminated wood. They come in 5-ft and 6-ft lengths and in nominal 24-in. and 30-in. widths. For continuous benching, they can be butted end to end or joined with two tops resting on the same drawer or cabinet pedestal. The "640" Series benches are interchangeable with other Hallowell benches of similar dimensions.

Standard accessories include back boards, end pieces, top shelves, drawer trays, and additional cabinet shelves.



Sponge Rubber Forms Canadian Operation

The Sponge Rubber Products Co., Shelton, Conn., U. S. A., has completed construction of companion facilities for the production of cellular rubber in Canada. At Waterville, Quebec, the completely new 67,000 sq ft area plant of Canadian Sponge Rubber Products, Ltd., will produce "Spongex" cord, sheets, die-cut shapes, and custom molded forms. "Cell-Tite," the company's name for cellular rubber having noninterconnecting cells, will be produced in soft and hard board forms. Principal use of Cell-Tite is in flotation and insulation.

Canadian Sponge Rubber Products, Ltd., will also produce continuous sheet stock which makes possible the manufacture for Canadian consumption of the company's biggest consumer product Spongex rug cushions, now heavily produced in the U. S.

Cellular rubber has countless applications as gasketing, cushioning, shock absorption, noise and vibration damping, thermal insulation; as a flotation medium and as sealing material. Its general use is explained as airtight, moistureproof insulation against the passage of dirt, liquids, noise, and vibration. One of the largest users of cellular rubber in all the applications named is the automobile industry.

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NEW EQUIPMENT
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Worthington Redesignates Dunellen Plant

What has been known as the Dunellen, N. J., plant of Worthington Corp. has been redesignated as the Plainfield Works. Though known as the Dunellen Works since 1943 when purchased from Ransome Machinery Corp., the plant is not actually located in the town of Dunellen. It is located partly in Plainfield, N. J., and partly in Piscataway Township which is between Plainfield and Dunellen. To provide proper designation the name and address of this plant, effective immediately, will be: Worthington Corp., Plainfield Works, Plainfield, N. J.

Kewanee and Ross Combine

Kewanee Boiler Corp. and Ross Heater & Mfg. Co., Inc., two divisions of American Radiator & Standard Sanitary Corp. have combined to form a new company, Kewanee-Ross Corp.

Kewanee has long been known as a leading manufacturer of steel heating and power boilers, with main offices and works at Kewanee, Ill., and an eastern plant at Lebanon, Pa.

Ross, a recognized leader in the manufacture of shell and tube heat exchangers, surface condensers and allied equipment, has its executive offices and plant in Buffalo, N. Y.

Both units of Kewanee-Ross Corp. will continue to operate as before, maintaining their respective plant locations, sales offices, and representatives. However, the unification of the management, personnel, and facilities of the two firms will provide a substantially broader scope of operations than was possible heretofore, enabling a wider range of related products and services. For example, in addition to manufacturing a complete line of boilers and allied equipment, Kewanee's heavier facilities and larger plant area will be utilized to produce heat exchangers and surface condensers of considerably greater size than had been economically feasible in the Ross plant. In turn, Ross facilities will be freed for producing increased quantities of smaller units. The two concerns thus complement and supplement each other's facilities ideally.

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When you visit this Southern industrial, transportation and distribution center, you will see many large enterprises like the Birmingham Slag Company that started, in a small way, just a few years ago.

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Second Largest Slag Processor in the Nation

Slag was formerly a waste by-product of Birmingham's blast furnaces. Founders of the Birmingham Slag Company foresaw the commercial possibilities of slag. They recognized that centrally located Birmingham would be the ideal distribution point to serve the South. They pioneered the first Southern plant to process slag. Rapidly their operation grew as slag uses diversified and demand boomed with the South's broad-scale building program.

Anywhere you go in the South, you will now see Birmingham slag . . . as ballast on the busy lines of railroads . . . in asphalt and concrete paving and the macadam bases of modern highways . . . in every kind of reinforced concrete construction . . . as moulded concrete block and tile . . . in fact wherever enduring aggregate is needed.

* * * * * *

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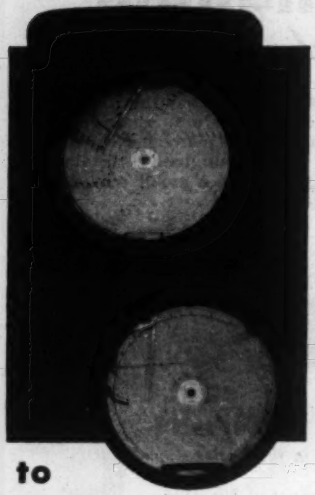
TEMPERATURE RECORDERS



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FOXBORO
TEMPERATURE RECORDERS

Keep Informed — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

Nooter Establishes St. Louis Metallizing Co.

The Nooter Corp., St. Louis, Mo., has announced the establishment of the St. Louis Metallizing Co., to be located at 625 S. Sarah St. Formerly the Metallizing Div. of the Nooter Corp., the newly formed company will retain the same personnel, equipment, and management.

Already known as one of the country's largest and best-equipped metallizing shops (as the Metallizing Div. of Nooter Corp.), the St. Louis Metallizing Co., with its new and specially designed facilities, will offer many additional advantages for fast, dependable service.

The metallizing process (by which molten metal is sprayed onto metallic and nonmetallic parts) permits worn machinery parts to be restored to original demensions for many years of renewed life, applies corrosion and contamination resistant metallic coatings to vessels, structures, boats, etc. Sprayed metal coatings are also used in the manufacture of plastic molds, corrosion-resistant processing equipment, and in the decorative field

In addition, the new company will offer two other important industrial services: hard surfacing and plastic coating. Hard surfacing is the application of wear and corrosion-resisting alloys by oxyacetylene, shielded arc, automatic arc, or inert arc methods of welding. Plastic coating is the application of plastic sheeting or liquid films to various types of processing equipment, to serve as barriers to corrosive media.

Westinghouse To Build Lighting Equipment Plant

Westinghouse Electric Corp. has announced its plans to build a multimillion dollar industrial and commercial lighting equipment plant in Vicksburg, Miss. It will be the largest plant in the nation devoted exclusively to the manufacture of industrial incandescent and industrial and commercial fluorescent fixtures.

The one story, steel and brick structure will feature the latest in industrial plant design and mechanized equipment. Both manufacturing and warehouse facilities will be provided. Located on a 55-acre site six miles south of the city, it will extend approximately 900 ft along U. S. Route 61.

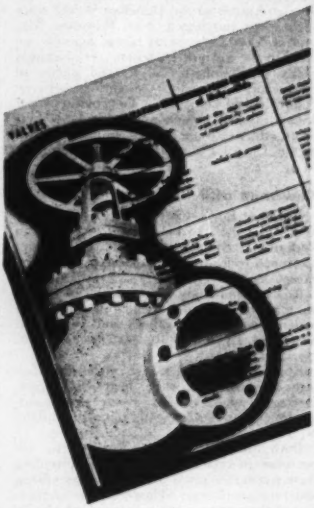
It was pointed out that the history of the lighting equipment business has shown that volume has roughly doubled every ten years and that there is every indication that this growth will continue. This plant is a direct result of the steadily growing market, and is part of the current Westinghouse $296,000,000 expansion program. As industrial and commercial fluorescent and industrial incandescent production is gradually moved to Vicksburg, the space freed at the Cleveland Lighting Division plant will be used to expand production of street lighting units, aviation lights of all kinds, and flood lights, as well as to boost output of military items.

Construction may get under way this month, and at that rate, the plant would be ready for occupancy by early fall of 1953.

The products turned out will include fixtures for fluorescent lights that go into schools, offices, stores and factories, as well as the ballasts for them. Also produced will be fixtures for incandescent and mercury lights that are used in industrial locations.

Moly-sulfide
A LITTLE DOES A LOT

is proving effective even where other lubricants have failed



Moly-sulfide, a solid-film lubricant, is proving so useful in difficult friction applications that new uses are found daily. 154 cases of how serious problems were solved are described in our new booklet. Your own problems may be like those described. Write for your copy of this booklet.

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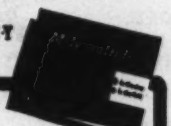

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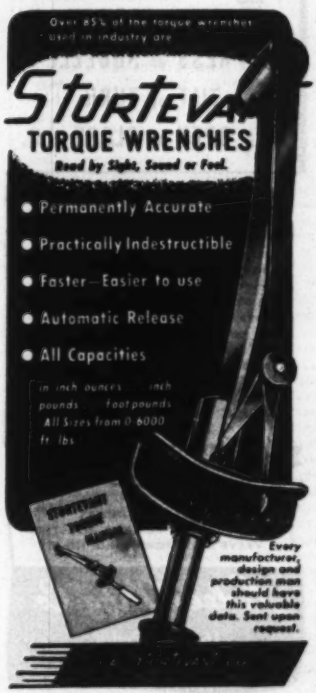
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Hewitt-Robins Opens Kansas City Office

Hewitt-Robins Inc., manufacturers of conveying and vibrating machines, as well as such industrial rubber products as hose and belting, have opened an additional office in the Porter Bldg., 406 W. 34 St., Kansas City, Mo.

Warren Names Cleveland Representative

Warren Steam Pump Co., Inc., announce the appointment of Process Industries Engineers, Inc., Pittsburgh, Pa., as their representatives on Industrial Sales for the Cleveland, Ohio, area.

Mr. Arch T. Miller, formerly Sales Engineer for Patterson Foundry & Machine Co., East Liverpool, Ohio, will be District Manager of the Cleveland Office, with headquarters at 12417 Cedar Road, Cleveland 6, Ohio.

Power Conversion Units

Syntron Co., manufacturers of selenium rectifiers has just issued a new piece of literature illustrating and describing their line of selenium rectifier power conversion units. The literature includes illustrations and specifications of the various models available according to capacity. Copies may be had by writing Syntron Company, 498 Lexington Ave., Homer City, Pa.

Automatic Gaging and Sorting

A new 20-page bulletin illustrates the various types of automatic gaging methods and gages designed and built by Products Corp., 1144 Eddy St., Providence, R. I. This also includes continuous measuring gages. All of these employ electromechanical and electronic systems for obtaining the desired results. They differ from the straight electrical sorting gages in that the electronic system enables parts to be sorted into numerous categories according to customers' requirements.

Chromium-Nickel Stainless Steels

A 32 page 18-table bulletin showing the results of tests on numerous austenitic stainless steels in various solutions, acid, neutral, and alkaline is available from INCO. A general publication that covers: the mechanism of corrosion resistance in stainless steels; factors affecting their corrosion; their behavior in various corrosive environments, marine and industrial atmosphere, in organic and inorganic acid salt solutions and in halogen salts and weak and strong bases; and the preferred practice in construction and use of stainless steels. It is shown that nickel in combination with chromium increases the corrosion resistance in both oxidizing and reducing solutions. In addition it has desirable effects in promoting austenitic structure and maintaining it during and following fabrication. International Nickel, Dept. EZ, New York 5, N. Y.

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NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

General Purpose Motors

Construction features, ratings and dimensions of Allis-Chalmers open drip-proof (Type AP) and splash-proof (Type APWW) squirrel-cage induction motors in ratings of 1/2 to 100 hp are described in a new bulletin. According to the bulletin, the motors are available with many special modifications such as totally enclosed, vertical mounting, flange mounting, and multispeed construction. All ratings are available in NEMA Design B, and most in NEMA Design C. The bulletin points out that Design B motors are suitable for the majority of cage motor applications. Copies of the bulletin, "Squirrel-Cage Induction Motors," No. 51B621OD, are available from Allis-Chalmers Mfg. Co., 949 S. 70th St., Milwaukee, Wis.

Humidity Conditioning Equipment

An 8-page bulletin describing a number of installed applications of Kathabar humidity conditioning equipment has been released by Surface Combustion Corp. Seventeen industries and 43 business and manufacturing firms in which this dehumidifying equipment is used are mentioned. The folder, bulletin No. K-152, is a collection of a series of 6 business paper advertisements describing various applications of humidity conditioning. The advertisements are gathered here for a condensed presentation to those busy industrial and business men who may have missed them. Dehumidifying case histories in the fields of laminated safety glass manufacture, pharmaceutical processing, moisture-sensitive products storage, hygroscopic powder packaging, and comfort air conditioning are included. Copies of this bulletin, "Humidity—Engineered to Order," may be obtained from Sales Promotion Dept., Surface Combustion Corp., Toledo 1, Ohio.

Graphitization Research Study

A 12-page booklet published by Edward Valves, Inc., comprehensively discusses the graphitization phenomena encountered in systems operated at elevated temperatures in the power and processing industries.

Based on an intensive research program in the Company's laboratories which has extended over the last 10 years, this research study describes in detail the nature of graphitization and its effects, and lists preventive and corrective measures. Profusely illustrated with photomicrographs of metallurgical specimens illustrating the graphitization process, the booklet also contains eutectic diagrams and graphs illustrating the effect of temperature, time, and other variables on graphitization. Separate sections in the article cover the effect of chemical composition, deoxidation practice, prewelding microstructure, welding conditions, stress, and strain.

Copies of the study may be obtained by writing to Dept. GA, Edward Valves, Inc., East Chicago, Ind.

For Consulting Engineers

Turn to Page 134

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WHEREVER YOU HAVE TO...

PUSH or PULL
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OPEN or CLOSE

Ledeen cylinders used for air, oil, water, gas or steam operation with medium, heavy or super-duty models, provide a large number of variations and adaptations to meet your specific power or motion requirements. They are available in many diameters and stroke lengths with suitable head and rod attachments to provide almost any desired mounting.
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NEW EQUIPMENT
BUSINESS NOTES
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Aircraft Data Slide Rule

A new "slide-rule" with silhouettes and published information on the latest military aircraft has been devised by the General Electric Co. Aircraft Gas Turbine Division, Lockland, Ohio.

One side of the plastic data chart provides a quick reference for information on air frames, operational data, and power plants of 42 aircraft. On the opposite side is the Douglas Aircraft Company's air speed versus altitude chart.

The slide rules, available in lots of 50 for $25, may be obtained by addressing a request for GEN-60 to the General Electric Co., Schenectady 5, N. Y.

Thermostatic Bimetal

A new 32-page booklet entitled "Successful Applications of Chace Thermostatic Bimetal" has recently been made available by the W. M. Chace Co. The booklet, a compact summary on thermostatic bimetal, contains 18 uses of bimetal as the actuating element in temperature responsive devices and condensed engineering data for bimetal element design and selection. It is illustrated with various types of thermostatic devices employing Chace thermostatic bimetal and other pertinent data. Reference is also made to the available facilities of the Chace engineering and research departments. Copies of the new booklet may be obtained from W. M. Chace Co., 1619 Beard Ave., Detroit 9, Mich.

Portable Pneumatic Instrument Calibrator

For calibration and testing of low-pressure instruments and controls such as flowmeters, draft gages, differential pressure transmitters, with ranges 0–20 in. water—pressure, vacuum or compound. Easier to use and more accurate than water-column manometers, especially for extremely low-pressure calibration. Accurately measures pressure or vacuum in increments of 0.01 in. Essentially a manually operated force-balance, the calibrator consists of a standard chemical weigh scale and an oil-sealed bell. Weights on the scale are balanced against an opposing air pressure in the bell. Thus, bell air pressure can be determined with laboratory scale accuracy and used as a standard for the calibration of an instrument. Fully described in bulletin No. 52-3, from Republic Flow Meters Co., 2240 Diversey Parkway, Chicago 47, Ill.

Heat Transfer Apparatus

The Griscom-Russell Co. have just completed a concise picture-book presentation of some of their many designs of heaters, coolers, condensers, and heat exchangers for all types of liquids, vapors, and gases. The material in the bulletin is arranged in sections to show some of the various types of G-R apparatus which are of particular interest to the oil and gas industry, power plants, general industrial and chemical plants, and the marine industry. The illustrations include views of equipment and representative installations, each accompanied by a brief explanation of design features and applications. The bulletin provides an informative reference to the extensive line of G-R heat-transfer apparatus, and copies can be obtained by addressing The Griscom-Russell Co., Massillon, Ohio., Department CC, and asking for the Progress issue of G-R News.

1951 API-ASME CODE

Unfired Pressure Vessels for Petroleum Liquids and Gases

This 1951 Edition applies to the design and construction of unfired pressure vessels subject to external pressures and to fusion-welded, riveted and integrally forged vessels. Provisions are included for periodic inspection, repair and allowable working pressures for vessels in service; materials to be used in construction are specified; suggestions are given regarding internal structures, corrosion allowance, protective linings, installation of pressure vessels, and design of supports; examples of computations are presented, also data and information useful to designers and inspectors.

The Revision was made by a widely representative committee under the sponsorship of the American Petroleum Institute and The American Society of Mechanical Engineers. In its preparation cognizance was taken of the advances in the field and changes in industrial practices since the publication of the 1943 Code by amplifying and modifying many of the existing rules, and introducing new material, such as: the details for minimum welding required around opening attachments, the acceptance criteria for pressure relief devices, recommendations pertaining to the use of materials classified as "New", more accurate shell and head design formulas, and the adoption of rules in the ASME Code to provide for high alloy and clad or lined vessels of the several types used.

Published, April 1952, 285 pages, 5¼ x 7¾ in size

$3.00 ($2.40 to ASME members purchasing one copy; $3.00 each for additional copies)

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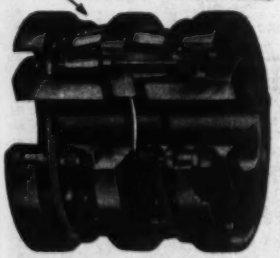

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Gas Burner Nozzles

A new catalog 804-C covering the latest enlarged line of "Retain-a-flame" Gas Burner Nozzles for industrial heat processing applications, has been issued by Hauck Mfg. Co., 124-136 Tenth Street, Bklyn. 15, N. Y. Capacities and other data are given on the 10 sizes of straight and 9 sizes of elbow-type nozzles now available. Spark and gas pilot ignition are explained.

Flow Rule and Handbook

Two essential tools in flow meter engineering, the Foxboro Flow Rule, which simplifies calculation of primary elements, and "Principles and Practice of Flow Meter Engineering," recognized as a basic text on fluid measurement, are now being offered in a combination purchase by The Foxboro Co., Foxboro, Mass.

Specially designed for rapid solutions to problems of line size, flow rate, and orifice sizing, the Foxboro Flow Rule has a reversible slide with scales for gas on one side, liquids and steam on the other, each fluid identified by a distinctive color. Accuracy of the Flow Rule is closer than can be read. Over-all length of the rule is 12 in. Complete instructions and cowhide carrying case are included.

"Principles and Practice of Flow Meter Engineering," by L. K. Spink, now in its seventh edition, contains 418 pages of tables, curves, and text, serving as a one-source reference of important data and an authoritative guide to the correct methods of measuring flow. An 8-page index is necessary to list the extensive presentation of material, ranging from Coefficient Tables (gas, liquid, and steam) to Weirs.

The Flow Rule and the Flow Meter Handbook are being offered in a combination purchase at $27. Bought separately, the price is $7 for the handbook and $25 for the Flow Rule. Checks or purchase orders may be sent to The Foxboro Co., Foxboro, Mass.

Crane Hoist Control

A new a-c crane hoist control, Load-o-matic®, is described in an 8-page booklet available from the Westinghouse Electric Corp.

For simplicity, operation of the Load-o-matic control is explained by using the analogy of a man raising or lowering a weight manually. Each hoisting action of a crane, "load suspended," "load lowered," and "load raised" is compared to a man's physical actions in accomplishing the same results with a small weight. In the man's case, the gravity-counteracting force exerted is controlled by his brain—in the case of Load-o-matic control, by the automatic "load detector" that divorces torque from speed and permits coordination of speed and load to suit requirements of the particular crane.

In addition to the simplified operation explanation, other sections cover construction, mounting, and performance characteristics. Six sets of motor speed-torque curves show how Load-o-matic control compares with other forms of crane control in combination with a-c wound-rotor induction motors. Associated equipment such as the master switch, resistors, holding brake, and the contactors, are illustrated and described.

For a copy of booklet, No. B-5417, write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.

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Electric
HEAT
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Univalves

A new 8-page catalog describing Univalve integral-seat all-purpose forged-steel valves rated for 1500 and 2500 lb has been issued by Edward Valves, Inc. Complete material specifications, including detailed chemical analyses as well as physical characteristics, are given. Graphic illustrations show outstanding Univalve features such as Impactor handwheel, streamlined straight-through flow passages, positive back-seat, and leakproof bonnet. A special picture section illustrates step-by-step simple disassembly procedures. Copies may be obtained by writing Dept. C U Edward Valves, Inc., 1200 West 145 St., East Chicago, Ind.

Expansion Joints

An illustrated bulletin describing the new Flexon line of expansion joints has just been released by Flexonics Corp. Recent design changes have produced improved Flexon expansion joints capable of accommodating increased expansion with fewer corrugations. The new bulletin gives complete specification and installation data for Flexon-type Free-Flexing joints for low-pressure applications, Controlled-Flexing joints for high pressure installations, and Flexoniflex joints for the handling of extremely high pressures. For a copy write Flexonics Corp., 1305 South Third Ave., Maywood, Ill., requesting catalog CMH-119R.

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Steel mills and foundries need more scrap.

Not just "production" scrap from metal-fabricating plants . . . but also all sorts of *idle* iron and steel—from all types of plants.

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What to look for . . .

obsolete machines, tools and equipment, no-longer-used jigs and fixtures, worn-out or broken chains, wheels, pulleys, gears, pipe, tanks, drums and abandoned metal structures. Non-ferrous is needed, too!

Milling and Processing Equipment

A new book, No. 2392, describing conveying, processing, and power transmission machinery particularly adapted to the grain milling and processing industries, is available from Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill. It contains information to aid in selection of conveying equipment, including screw conveyers, belt conveyers, bucket elevators, Bulk-Flo, oscillating conveyers, and related components. The booklet also includes descriptions of a railroad grain car unloader which unloads up to 10 cars per hour by tipping them 40 deg endwise in each direction and 15 deg sidewise; two types of dryers for drying, cooling, or roasting; vibrating screens for accurate sizing and screening; and drives for practically every purpose, including variable-speed drives, fluid drives, chain drives, and a complete range of enclosed gear drives.

Mixing Machines

Struthers Wells intensive mixers, dispersion machines, mixing machines, and kneading machines are described in a new 4-page bulletin published by Struthers Wells Corp. Designed for processing a wide range of materials, this line of machines is for heavy-duty intensive mixing through light-duty mixing and kneading. Featured in the bulletin is the Struthers Wells intensive mixer, said by the manufacturer to be the most powerful mixing machine ever developed for internal processing and compounding of difficult, tenacious materials. In addition to descriptive data, the bulletin includes a chart which gives capacity, series number, rotor rpm and horsepower for the 19 standard sizes of intensive mixers. Thirteen standard sizes of dispersion machines, mixing machines, and kneading machines also are considered in the brochure. These range in working capacity from 1 through 1000 gal. Copies of bulletin No. T-452 may be obtained from Struthers Wells Corp., Mixer Div., Titusville, Pa.

Protective Buildings

A 44-page catalog entitled "Insul-Mastic In Industry" has been published by the Insul-Mastic Corp. of America, 1141 Oliver Building, Pittsburgh 22, Pa.

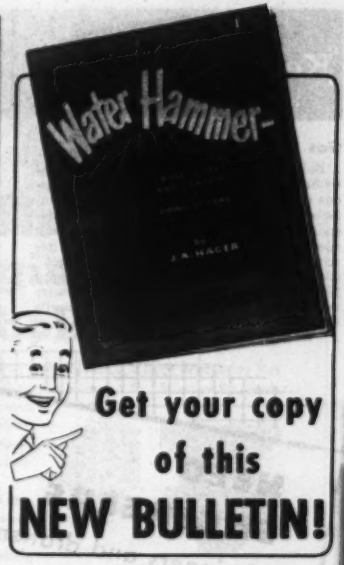
This company manufactures Gilsonite base protective coatings, and the new book describes these coatings, their properties, their uses, and tests to which they have been subjected. Related products such as caulking compounds, primers, and membraning material are also described since they augment the use of the company's coating.

Insul-Mastic coatings are used mainly to prevent corrosion of industrial equipment—especially in chemically contaminated atmosphere to waterproof buildings, and to act as a weather barrier or vapor barrier over thermal insulation.

A special cork-filled coating is also described in the book. This coating performs the double function of preventing corrosion and insulating. It is recommended for use in the atmospheric temperature range to prevent heat loss or to control condensation.

The new Insul-Mastic catalog contains numerous photographs of chemical vessels, industrial equipment and buildings which have been protected by Insul-Mastic coatings.

"Insul-Mastic In Industry" is available as a guide to maintenance and for the writing of specifications.



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This important new Bulletin WH-851 explains in detail the causes and damaging effects of costly Water Hammer—and how it can easily be controlled with Williams-Hager Silent Check Valves. Learn how Water Hammer can be quickly and inexpensively controlled *in your piping system*—send for your copy of this new bulletin today.

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Please send a copy of Bulletin WH-851 on "Water Hammer, Cause, Effect and Control in Piping Systems."

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ME-852

Gas Scrubbing Equipment

Bulletin supplement 4RA, recently issued by Schutte and Koerting Co., outlines various types of gas scrubbing equipment manufactured by the company. Pictured and described are applications; construction and operation features; component parts; gas scrubbing systems; and the new "packaged" gas scrubber unit. Copies of bulletin supplement 4RA may be obtained from Schutte and Koerting Co., Dept. J-H, Cornwells Heights, Bucks County, Pa.

Pipe and Tubing

An Addenda Errata Booklet covering revisions in order to bring Tube Turns catalog No. 211 up to date. It has been designed to fit into the pocket at the back of the catalog. Code changes, plus an additional column of design information, have also made necessary the preparation of a new Design Properties of Pipe table, superseding table No. 2 beginning on page 204 of the catalog, and presented in convenient booklet form. Available from Tube Turns, Inc., Louisville, Ky.

NEED ENGINEERS

designers and draftsmen for

NON-AIRCRAFT WORK

Long-range development program involving small gas turbines and their application to mobile equipment.

- Development Engineer
- Designers for layout and production design
- Draftsmen

ALSO NEEDED

- Development Engineer for air conditioning . . . experience in general air conditioning required.

Apply, write or telephone Phil Carr

AiResearch Manufacturing Co.

9851 Sepulveda, Los Angeles 45

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Filtration

A 4-page booklet, PL-200, gives thumbnail description of standard models of Fulflo filters for microscopic clarification of industrial liquids and gases, provides detailed description of honeycomb filter tubes. Gives essential data on single and multitube filters of capacities from 6 to 60,000 gph. Steel, brass, rubber-lined steel, and stainless-steel models. Special applications. Commerical Filters Corp., Boston & Melrose, Mass.

Sump Pumps

Bulletin No. WQ-220, 8 pages, illustrates and describes wet and dry pit types for clear liquids, sewage, and other liquids containing solids. Exterior and sectional views, impeller designs, dimensions, and selection charts are included. Available from Warren Steam Pump Co., Inc., Warren, Mass.

Elevated Steel Tanks

A 16-page bulletin available from Chicago Bridge & Iron Co., Chicago, Ill., illustrates Horton elevated steel tanks of welded construction. They are streamlined structures with cylindrical columns and ellipsoidal roofs and bottoms.

Control Valves

A new catalog, No. 552, published by W. H. Nicholson & Co., 12 Oregon St., Wilkes-Barre, Pa., describes and lists Nicholson control valves. Covered are the flat disk design in 2, 3, and 4-way types.

Miniature Ball Bearings

A catalog containing complete specifications on more than 120 different types and sizes of miniature ball bearings has been issued by Miniature Precision Bearings, Inc., Keene, N. H. In addition to the basic catalog(52B), additional engineering data sheets covering load ratings, clearances, tolerances, bearing installations, etc., are available.

Dryer Furnaces

A new, 4-page catalog, No. 36, on dryer furnaces for the coal, grain, beet sugar, chemical, lumber, salt, and associated industries has been published by Bigelow-Liptak Corp., 2550 W. Grand Boulevard, Detroit 8, Mich. The catalog describes the advantages of unit-suspended walls for this type of construction and tells how thin walls are deliberately made cool, minimizing heat losses, and adding to the efficiency of the furnace.

GIVE BIG NOW

DON'T GIVE TOO LITTLE TOO LATE!

Keep Informed

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Gravity Filters

A comprehensive and well-documented 24-page booklet, No. 2539A, of interest to all engineers dealing with water problems has been prepared. It shows the complete line of gravity filters and filter accessories manufactured by The Permutit Co., New York, N. Y. Specifications, operating characteristics, outline dimensions, and typical installation photographs have been included in this new edition.

Oil and Gas Combustion Equipment

Catalog No. 52, published by Hauck Mfg. Co., 124-136 Tenth Street, Bklyn. 15, N. Y. gives a condensed and pictorial review of Hauck oil and gas combustion equipment for production, construction, and maintenance applications in industrial plants. The 12 pages contain 80 illustrations and text arranged for convenience of the readers.

For industrial plants having seasonal shortages of natural gas, an easy means of stand by oil firing is explained in catalog No. 715. It illustrates typical applications to Hauck gas burner nozzles.

Multi-Louvre Dryers

A new 24-page book, No. 2409, on Multi-Louvre dryers, published by Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill., offers a great quantity of information on the drying, cooling, and processing of bulk materials. An accurate, yet clearly understandable explanation of basic principles of heat drying is provided. It tells how air absorbs moisture; why air and material must be heated; why material must be agitated; why moisture must be exhausted promptly.

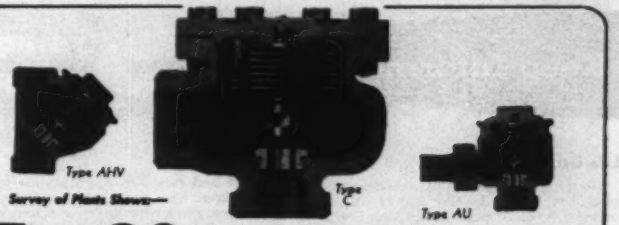
Detailed description of the Link-Belt Multi-Louvre dryer and how it works is included, followed by typical layouts, dimensional data, and a two-page psychrometric chart.

Check Valves

A new 2-page bulletin fully describing Golden-Anderson's hydraulic double-cushioned check valves is available from Golden-Anderson Valve Specialty Co. Two detailed drawings show the complete list of parts. The application, construction, sizes, and pressures are fully described along with tables showing general dimensions and figure numbers. This new bulletin, No. WS-1, may be obtained from Golden-Anderson Valve Specialty Co., 2113 Keenan Building, Pittsburgh 22, Pa.

Counterflo Heaters

A revised edition of a 12-page bulletin describing Dravo "Counterflo" Heaters, is available from Dravo Corp., Heating Dept., Fifth and Liberty Avenues, Pittsburgh 22, Pa. Principal addition to the bulletin, No. 523-B, is information concerning use of the heaters for eight other applications besides space heating. These are functional heating, process drying, temporary heating, medium temperature drying, tempering make-up air, drying vehicles after washing, crop drying, and integration with air-conditioning systems. Counterflo Heaters, direct-fired either with gas or oil, are supplied in standard output capacities ranging from 400,000 to 2,000,000 Btu per hr.

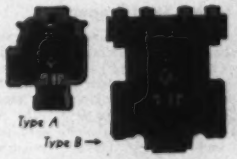


Survey of Plants Shows—

15 of 20 Engineers Prefer Nicholson Traps

To determine the best steam trap on which to standardize, a large processing firm recently asked their plant engineers for their preference. In 15 out of 20 plants the choice was Nicholson. The repeated adoption of Nicholson steam traps in plants currently in big "cost-reduction-through-modernization" programs is another indication of their advanced features.

5 TYPES for every power, heat, process use. Sizes, ¼" to 2", pressures to 250 lbs. To see why an increasing number of leading plants are standardizing on Nicholson thermostatic steam traps send for BULLETIN 152.



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Is Space an Important Factor?

Then Use This Distinguished Line of Close-Coupled Pumps

These GMC Pumps are ideal for a multitude of jobs. Smooth and efficient whether vertical, horizontal, up-side-down or any inclination. Low first cost, low power and maintenance costs. Top quality "by Aurora."

Caps. 10 to 800 G.P.M. Heads to 250 Ft.

PUMPS by Aurora

Type GMC Aurora Close-Coupled Pump

Write TODAY for CONDENSED CATALOG "M"

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Aurora Always Pumps

AURORA PUMP COMPANY

96 LOUCKS STREET, AURORA, ILLINOIS

Life-Line Motors

Over 100 case histories of outstanding applications of Life-Line® motors are depicted in a new 35-page booklet, No. B-4769, available from the Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa. Picked from the more than 3/4 million Life-Line motor applications in existence today, these case histories represent practically every phase of industry. Included are actual applications in the chemical, textile, petroleum, lumber, metalworking, paper, food, mining, and machine and production tool industries.

8½% Nickel Steel Properties

A 12-page bulletin describes a ferritic steel that is resistant to the embrittling effects of low temperatures (−320 F) and which can be welded and fabricated under somewhat the same conditions as engineering steels. Twenty tables and charts depict the mechanical properties and the effects of heat-treating and welding. Though low-carbon 8½% nickel steel is of special interest to petroleum refining and chemical processing fields, corrosion-resisting applications are suggested for it in oil-well, pulp and paper, machine-tool, and other industries. International Nickel, Dept. EZ, New York 5, N. Y.

Smoke Control

Ways and means to guard against panic and damage from smoke accidentally introduced into the air intake of air-conditioning systems is the subject of Bulletin 521, available from Ess Instrument Co., 96 South Washington Ave., Bergenfield, N. J. The 4-page brochure includes descriptions and diagrams of all three models of the Ess smoke controls, including one that eliminates the necessity for wall break-throughs by flush mounting. A remote-reading model is also described and illustrated for installation where the main duct is some distance from the main fan controls.

Controllable Capacity Pumps

Aldrich Data Sheet 65A describes applications, features, design, and operation of Aldrich-Groff "Powr-Savr" controllable capacity pumps (11 to 100 bhp). Data Sheet includes sectional and dimension drawings, ratings, and a diagrammatic layout of the Aldrich type "A" automatic hydraulic stroke-control system for boiler feeding, oil burner supply, and similar applications. "Powr-Savr" pumps are plunger type employing a mechanism which controls length of plunger stroke and thus controls delivery without requiring a change in speed of pump motor, turbine, or other prime mover. The Aldrich Pump Co., Allentown, Pa.

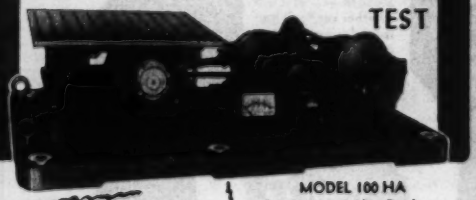
Altitude Control Valves

A new 16-page bulletin fully describing the features of Golden Anderson's cushioned altitude control valves is available from Golden Anderson Valve Specialty Co. Featured in this catalog are illustrations, operating sequence, and installation arrangements of the various single and double-acting altitude control valves. General instructions, parts lists, and dimensions are shown, along with a special section on maintenance. This new bulletin, No. W-4, may be obtained from the Golden Anderson Valve Specialty Co., 2113 Keenan Building, Pittsburgh 22, Pa.

Seamless Carbon Steel Tubing

The many advantages that accrue to manufacturers through the use of tubing in the production of hollow precision parts are outlined in a new data card published by the Tubular Products Div. of The Babcock & Wilcox Co. In addition to pointing out the savings in time and costs that come through the use of seamless cold-drawn carbon steel mechanical tubing for the production of such parts, the bulletin presents tables of tolerances and mechanical properties of such tubing. Copies of the bulletin, No. TB 339, are available on request to the general offices of the division at Beaver Falls, Pa.

Give Parts, Assemblies a Positive
VIBRATION TEST



ALL AMERICAN VIBRATION FATIGUE TESTING MACHINE

MODEL 100 HA
Capacity 100 Lbs. Produces Vibrations horizontally. All controls in easy reach.

NATIONAL Bureau of Standards uses four, Mass. Inst. of Technology two, Western Electric 13, Westinghouse and G. E. 12 each. Basic Equipment for YOUR testing laboratory or inspection department. In many plants a laboratory in itself. Detect excess weight—find structural weak spots.

For electronic, automatic aircraft, crystal, optical and instrument makers, schools and research laboratories. Models to test parts from a few ounces to 100 lbs. Choice of horizontal or vertical table movement. Frequencies of 600 to 3600 v. p. m. Automatically or manually controlled. Send for Catalog F.

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SPRAY NOZZLES

. . . FOR EVERY NEED!

For lower cost and more efficient spraying try Spraying Systems Spray Nozzles. Complete type and size selection for every need. Write for Catalogs.

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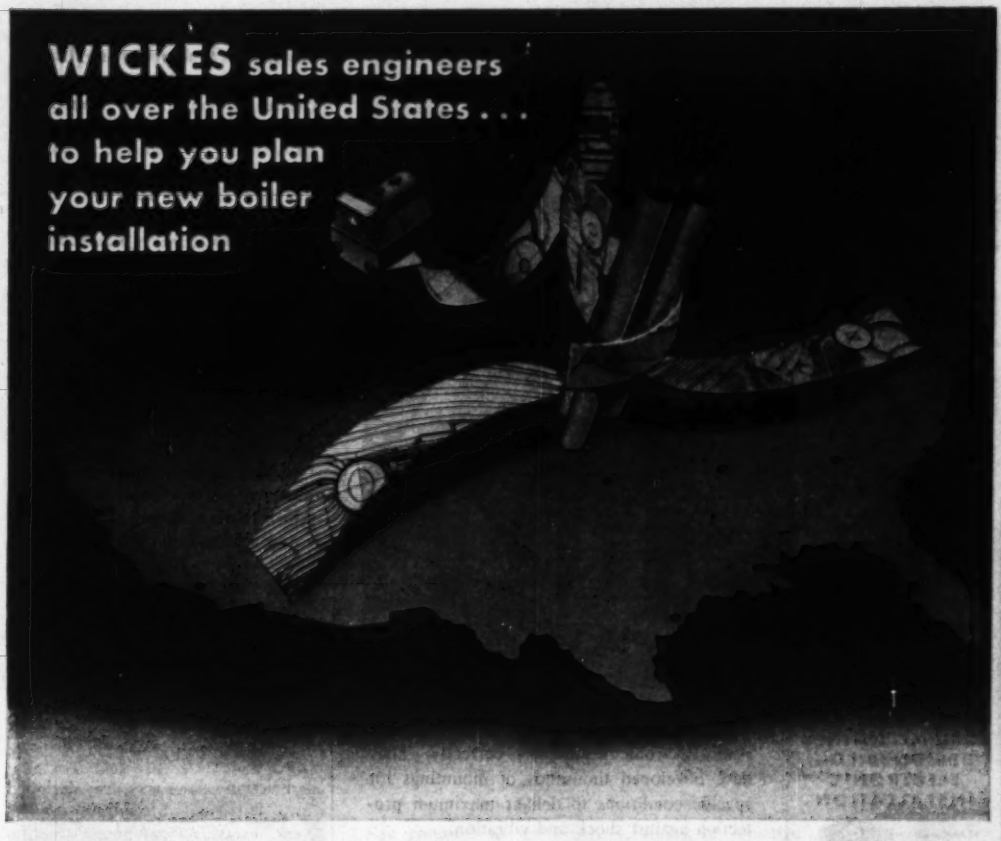
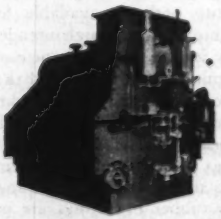


In twenty-three principal cities in the U. S. and in several industrial centers outside the country there is a Wickes sales engineer—who really knows boilers—ready to help you. This widespread sales organization, alone, helps greatly to increase the service you get from Wickes, and once you place an order for a Wickes boiler, Wickes engineers and production men get into production without delay. Wickes knows that when you want steam generating equipment, you want it. A Wickes installation is a complete installation. One contract covers all controls, all accessories, all engineering, all work from original survey to final brick-work and installation ready-to-go. ✓ ✓ ✓ Throughout the world, industries and institutions that depend on steam have learned to depend on Wickes for efficient, low cost steam power. Wickes can fill your requirements for steam generating equipment up to 250,000 lbs. per hour and 1000 psi.—all types of multiple drum boilers adaptable to any standard method of firing. Write today for complete information or consult a Wickes sales engineer.



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THE WICKES BOILER COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN

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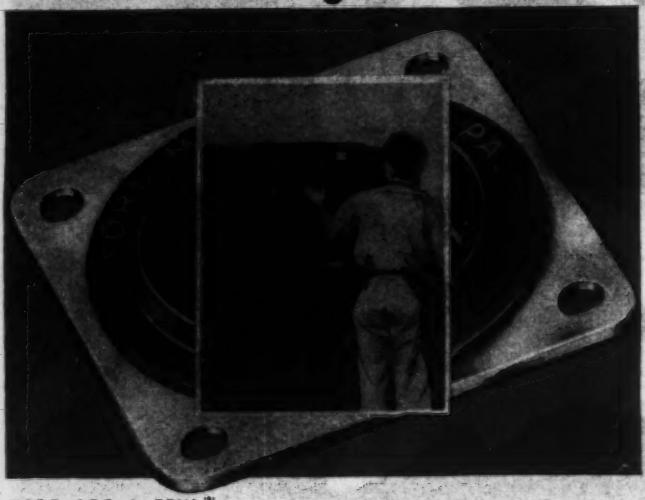
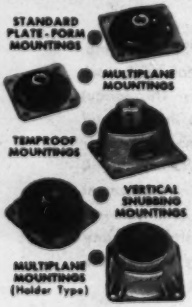
RECOGNIZED QUALITY SINCE 1854

MAXIMUM PROTECTION for ELECTRONIC EQUIPMENT. Lord Mountings, of Course!



HERE ARE A FEW LORD MOUNTINGS DESIGNED FOR ELECTRONIC INSTALLATION



Lord engineers are best prepared to mount your electronic equipment correctly. They have developed thousands of mountings for specific conditions to deliver maximum protection against shock and vibration.

You can draw from this reservoir of proved mountings with greatest economy and speed.

However, if your electronic equipment demands a specially designed mounting, Lord engineers will work with you to develop the most efficient and economical mounting you can buy.

Take advantage of Lord Engineering "know-how" and modern production facilities.

For immediate consultation call or write—

BURBANK, CALIFORNIA
233 South Third Street
ROckwell 9-2151
CHarleston 6-7481

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520 N. Michigan Ave.
Michigan 2-6010

DALLAS, TEXAS
1613 Tower Petroleum Building
PRospect 7996

DAYTON 2, OHIO
138 Lafayette Street
Michigan 8871

DETROIT 3, MICHIGAN
7310 Woodward Ave.
TRinity 5-8239

NEW YORK 16, NEW YORK
280 Madison Avenue
MUrray Hill 5-4477

PHILADELPHIA 7, PENNSYLVANIA
725 Widener Building
LOcust 4-0147

ERIE, PENNSYLVANIA
1635 West 12th Street
3-2296

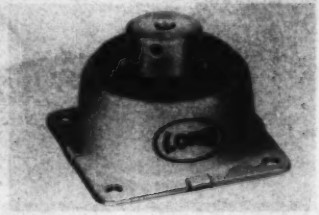
LORD MANUFACTURING COMPANY • ERIE, PA •

LORD — HEADQUARTERS FOR VIBRATION CONTROL MOUNTINGS AND BONDED RUBBER PARTS

New Mounting Operates In Wide Temperature Range

An entirely new type of vibration control mounting is announced by Lord Manufacturing Company, Erie, Pa. Designed specifically to meet the requirements of base-mounted airborne electronic equipment, the new mounting has been named TEMPROOF (temperature-proof) because of its ability to function efficiently throughout the entire range of operational temperatures from -80°F to 250°F.

TEMPROOF Mountings are designed for use with Government Specification JAN-C-172A equipment. According to the manufacturer, TEMPROOF Mountings not only pass but actually exceed the requirments of Specification AN-E-19 which requires that mountings withstand a 30G drop test.



Friction dampers are designed into TEMPROOF Mountings to prevent excessive equipment motion at resonant frequencies. Mounting drift has been reduced to a negligible amount, which eliminates the tendency of equipment to sag or droop after long periods of service. TEMPROOF Mountings function efficiently over a wide range of loadings, which makes it practical for manufacturers to standardize upon one mounting for several types of equipment.

Information from the manufacturer indicates that TEMPROOF Mountings are now being produced in quantity and are available for prompt shipment. Although intended primarily for use with airborne electronic equipment, it is believed that these mountings will fill an additional need in the industrial field for applications of vibration control mountings in areas subject to temperatures above and below the range in which rubber mountings are ordinarily used. Complete information on TEMPROOF Mountings will be supplied by the manufacturer upon request.

Lord Mountings Provide Complete Shock Protection

A new method for shockproofing shipments has been introduced by Lord Manufacturing Company, Erie, Pa. The system calls for support of the item to be protected within the case by means of shear type rubber mountings which isolate shock forces and prevent damage when the case is dropped or roughly handled.

A standard of performance is determined by defining the height from which the shipment must fall without damage to its contents. On the basis of this data, the Lord Engineer selects a size and type of flexible mounting which provides the correct amount of flexibility and restraint in each plane to prevent exposure to excessive shock stresses. In effect, each mounting is engineered to the exact requirements of a particular item.

This new method eliminates the many disadvantages of loose packing materials, the fact that the shipper cannot calculate and supply exactly the right amount of resiliency to insure maximum protection regardless of the position in which the case may fall.

Some idea of the efficiency of Lord Shipping Mounts is obtained from the fact that drop tests at Burroughs Adding Machine Company proved that the Typewriter Accounting Machine shown above could be dropped thirty-six inches without damage. Further proof of their ability to furnish protection is offered by well over a thousand foreign shipments which arrived without breakage or malfunction. An important consideration in selecting these mountings is the fact that they can be re-used indefinitely. Packing and unpacking time is greatly reduced and most important, cost of inspection and adjustment at destination is reduced by 75%.

Say goodbye to the costly servicing of sensitive equipment at destination — For one user Lord Shipping Mounts cut service and inspection time on overseas shipments from as many as 30 hours to only 4 hours.

Lord Shipping Mounts in your cases protect sensitive mechanisms in transit by cushioning the shocks of rough handling. This protection prevents maladjustment, greatly reducing costly servicing at destination.

If you are paying sizable service and inspection charges on newly shipped machines, stop it now. Lord Engineers will help you. Lord Shipping Mounts provide shock protection far superior to any other packing method . . . and they can be used indefinitely. To cut your shipping costs call or write to—

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Michigan 2-6010

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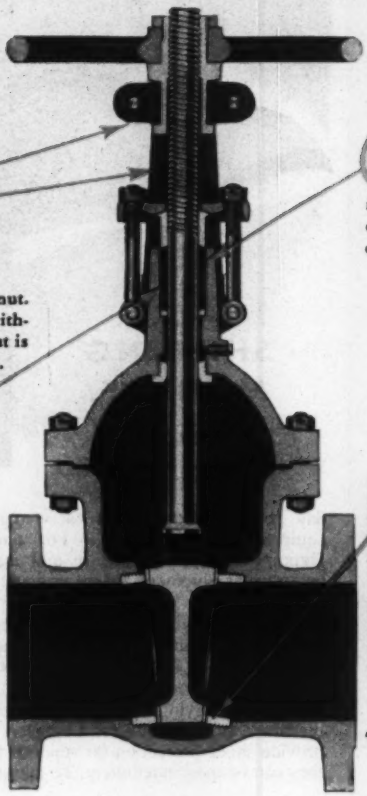
LORD MANUFACTURING COMPANY • ERIE, PA.

LORD
VIBRATION CONTROL MOUNTINGS
. . . BONDED RUBBER PARTS

"BUILT TO THE SAME SPECIFICATION STANDARDS – I THOUGHT ALL STEEL VALVES WERE ALIKE AS TWO PEAS"

OIC BUILDS FROM THAT POINT UP

LOOK AT THESE FOUR FEATURES:



1 2-PIECE YOKE DESIGN

simplifies replacement of yoke nut. Permits replacement of yoke nut without shutting down the line. Yoke nut is OIC Alloy 40; non-galling material.

2 STUFFING BOXES

have greater depth than is specified, permitting the use of 7 to 9 rings of packing, with either wiper rings or condensing chamber below.

3 OIC'S SEAL-EVER PACKING

(exclusive with OIC) lasts 10 to 15 times longer than ordinary packing. It stops pitting and corrosion of stems.

4 SEAT RINGS

are end-seated and are subjected only to compression forces when valve is closed; no loosening of seat rings with repeated opening and closing of the valve. No open spaces to cause turbulence, accumulate dirt and hasten corrosion.

THE BEST STEEL VALVE YOU CAN BUY

This combination involving yoke design, stuffing boxes, packing and seat rings is evidence of OIC's desire to build *beyond* minimum specifications.

THE OHIO INJECTOR COMPANY, WADSWORTH, OHIO

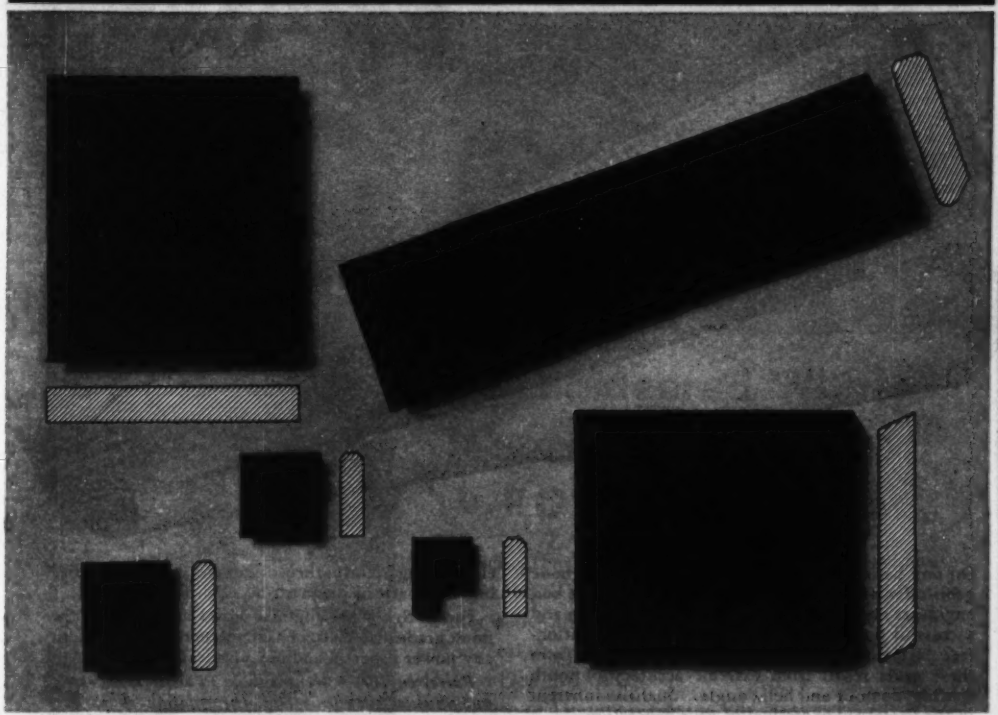
OIC

VALVES

FORGED AND CAST STEEL · IRON · BRONZE

NATIONAL

TRADE-MARK



ACCURATE FINISH • LOW FRICTION • DIMENSIONAL STABILITY • MECHANICAL STRENGTH •
HEAT RESISTANCE • SELF LUBRICATING • WEAR RESISTANCE • CORROSION RESISTANCE

LOW LIGHT BILLS...
mark phenomenal acceptance of "EVEREADY" No. 1050 Industrial Flashlight Batteries by a broad cross-section of industry. Delivering twice the usable light of any battery we've ever made before, it will not swell, stick or jam in the flashlight . . . has no metal can to leak or corrode.

● "National" Carbon Rotor Vanes for pumps and compressors are precisely machined and finished from a special carbon-base material which provides a combination of properties unmatched by any other kind of material for this service.

Precision machined to your blue-print specifications, "National" Rotor Vanes are your answer to tough operating problems such as corrosive liquids and gases, high temperatures, case-galling, warpage and other sources of frequent and costly maintenance.

Engineering assistance in the design and the application of "National" Rotor Vanes is available through our district offices listed below.

The terms "National" and "Eveready" are registered trade-marks of Union Carbide and Carbon Corporation

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A Division of Union Carbide and Carbon Corporation
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WHAT YARDSTICK DO YOU USE IN SELECTING GEARS?

On any basis of selection, Farrel-Sykes herringbone gears offer a number of advantages to designers and engineers responsible for the correct application and successful operation of gears. The quiet, vibration-free performance and long life you can expect from these gears result from extreme accuracy of tooth spacing, contour and helix angle...qualities inherent in the Farrel-Sykes method of gear generation.

The herringbone design provides a maximum number of gear teeth always in mesh. Overlap or interlacing of the teeth, together with gradual engagement, contribute to smooth operation. Opposed helices balance and absorb axial thrust within the gear member, eliminating harmful thrust loads and resultant stresses on other parts of the machine.

Farrel-Sykes herringbone gears are made of the finest grade materials, in a complete range of sizes for any power capacity and any application.

Farrel engineers are available to assist in working out unusual gear problems. Information about herringbone gears, or any of the other types mentioned on this page, will be sent on request.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y. • *Sales Offices.* Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Detroit, Chicago, Memphis, Minneapolis, Portland (Oregon), Los Angeles, Salt Lake City, Tulsa, Houston, New Orleans

Farrel-Birmingham®

FB-648

HERRINGBONE GEARS

Farrel-Sykes herringbone gears are available in any size from ¾ inch to 20 feet diameter, ¾ to 60 inch face, 24 DP to 0.75 DP.

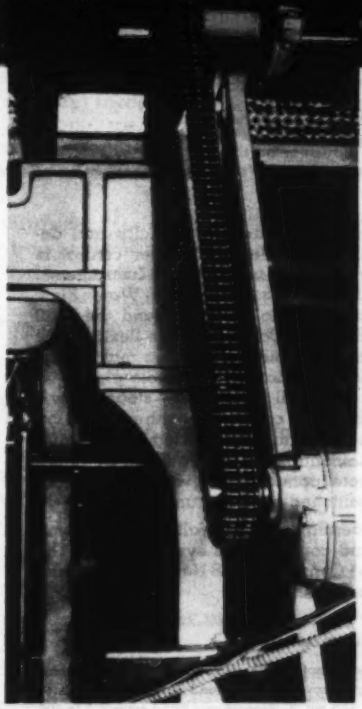
STRAIGHT TOOTH AND SINGLE HELICAL GEARS

Farrel also supplies straight tooth (spur) gears and single helical gears in any size from ¾ inch to 20 feet diameter, ¾ to 30 inch face, 24 DP to 0.5 DP.

INTERNAL GEARS

Large internal gears are available with either spur or helical teeth, in sizes up to 18 feet diameter, 12 inch face, 1¼ DP.

SIMPLIFIED DRIVING »
of a Series of Rollers



On the Clermont Sheet Former Matzo Machine, the power transfer medium is Diamond double 433 Chain.

Engineered With
DIAMOND
ROLLER CHAINS

• Practical machinery design engineers make wide use of DIAMOND Roller Chains to accomplish results not easily done otherwise. As an example, note the driving of several stages of rollers on the Clermont Machine Co. Matzo Dough Roller.

By use of Diamond Chains, the engineers simplified the design, kept weight to a minimum, and provided the exact, though different speed ratios for the several stages, and insured long-life, trouble-free operation.

For peace-time competition and defense preparedness production, you can rely on the dependability of power transfer that *Diamond* Roller Chains provide.

DIAMOND CHAIN COMPANY, Inc.
Dept. 413, 402 Kentucky Avenue, Indianapolis 7, Indiana

Offices and Distributors in All Principal Cities

Refer to the classified section of your local telephone directory under the heading CHAINS or CHAINS-ROLLER

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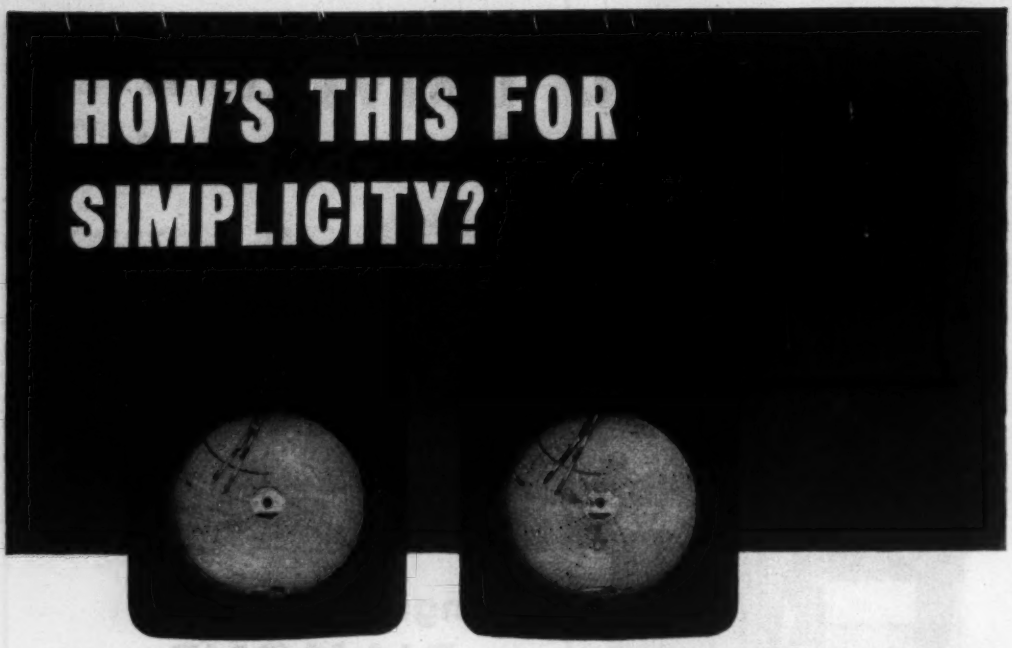


M-40 Recording Liquid Level Controller

M-40 Recording Steam Flow/Water Flow Pneumaticset Ratio Controller

3-Element Control for Boiler Feed Water with ONLY 2 INSTRUMENTS... NO AVERAGING RELAYS

Here's an opportunity to simplify boiler feed water control . . . and make it more dependable too. With this Foxboro system on a boiler of high steaming rate and low drum capacity, you get all the advantages of 3-element control, plus ratio-setting automatically adjusted by boiler water level. Ratio setting is undisturbed by the temporary effect of "swell" or "shrink" caused by sudden load changes.

This new standard of simplicity and dependability in boiler feed water control is made possible by two Foxboro Instruments, the M-40 Recording Steam Flow/Water Flow Pneumaticset Ratio Controller and the M-40 Recording Level Controller. The flexibility of Pneumaticset is outstanding . . . making the following combinations available almost instantly: (a) full automatic—steam flow/-water flow ratio controlled, with ratio set by level; (b) semi-automatic—steam flow/water flow ratio controlled, with ratio set by hand; (c) remote manual—feed water valve manually positioned from instrument.

Engineering data are available to help you check and compare this system. Write The Foxboro Company, 1828 Neponset Avenue, Foxboro, Mass., U. S. A.

THESE M-40 FEATURES INSURE UNUSUAL RELIABILITY

1. Unmatched ease and stability of adjustment 2. Emergency-proofed—instrument can be dismounted without disturbing manual control panel 3. Self-aligning ball linkage—pinch clip for easy removal 4. Main and sub-assemblies interchangeable with those of other M-40 Controllers 5. Precision-built, inside and out 6. Proportional band setting, 0 to 200, either direct or reverse action made by turn of dial 7. Wide range variable reset resistance, 0.1 to 50 minutes, without use of needle valves or lengths of capillary tubing

FOXBORO

RECORDING · CONTROLLING · INDICATING INSTRUMENTS

BROOKLYN was "unprintable"

Recently, The Consolidated Edison Company (in New York City) faced this problem: It had to produce a direct-process print from each one of more than ten thousand Brooklyn Underground Record Maps, showing the distribution system of electric service.

But satisfactory prints could not be produced directly from these maps. They were up to 30 years old . . . had been referred to constantly . . . and as a result were soiled, stained, creased, and "dog-eared."

What to do? Retracing was out of the question, since it would take a draftsman from two to three days to trace and check just one of these 17" x 25" drawings.

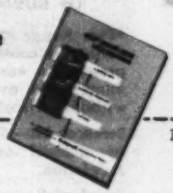
Kodagraph Autopositive Paper was the speedy, economical solution

With this revolutionary photographic intermediate paper, approximately 40 sharp and clean "duplicate originals" could be turned out in an hour. *Yes, 40 in an hour* because Kodagraph Autopositive Paper produces positive copies directly—without a negative step, without darkroom handling. At the same time, it drops out stains, creases . . . cleans up backgrounds . . . transforms weak detail into dense photographic black lines. Furthermore, Autopositive Paper can be exposed in standard print-making equipment . . . and processed in standard photographic solutions.

Thus, Consolidated Edison obtained—*in record time and at minimum cost*—a complete set of duplicate originals, which were used to produce the required direct-process prints . . . and were then filed away for future reference work and print-making needs.

Kodagraph Autopositive Paper

"THE BIG NEW PLUS" in engineering drawing reproduction



Learn in detail all the ways you can save with Kodagraph Autopositive Paper—the revolutionary photographic intermediate material which you, or your local blueprinter, can process *quickly . . . economically . . . at low cost.* Mail coupon today for free booklet!

16

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Industrial Photographic Division, Rochester 4, N. Y.

Gentlemen: Please send me a copy of "New Short Cuts and Savings"... describing the many savings Kodagraph Autopositive Paper is bringing to industry.

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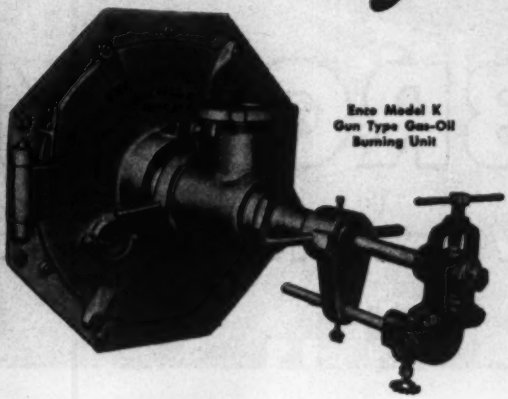
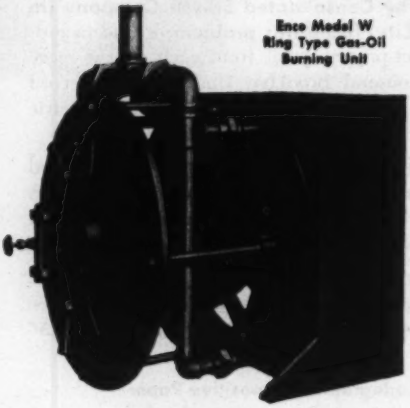
flexible... 3 ways

ENCO
OIL AND GAS BURNER UNITS



Enco Model K
Gun Type Gas-Oil
Burning Unit

These specially designed oil and gas burner units fit your needs . . . even when your operating conditions keep changing. Enco Oil and Gas Burner Units offer money-saving flexibility on three important counts. (1) They are designed for use with either oil or gas — or both . (2) They assure completely uniform combustion and greater fuel economy though steam demands swing sharply. (3) They can be operated by either natural or forced draft.



Enco Model W
Ring Type Gas-Oil
Burning Unit

Even if your old combustion equipment "works", it pays to investigate the fuel-saving economies and full flexibility of these highly efficient units. Enco Burner Units are made in many sizes to suit all capacity requirements. Bulletin on request.

ENCO
INTERCHANGEABLE ATOMIZERS
FOR USE WITH ALL TYPES OF BURNER EQUIPMENT

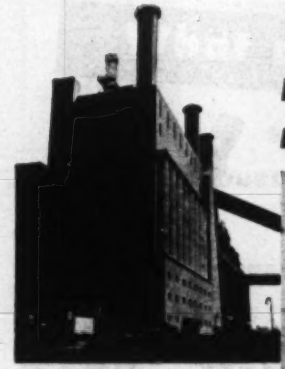
Wide Range Mechanical—Manual or automatic control. Constant high oil pressure at atomizer insures efficient atomization over entire load range without recirculating or returning oil.

Steam or Air—Wide range. Controlled by manual or automatic pressure regulation.

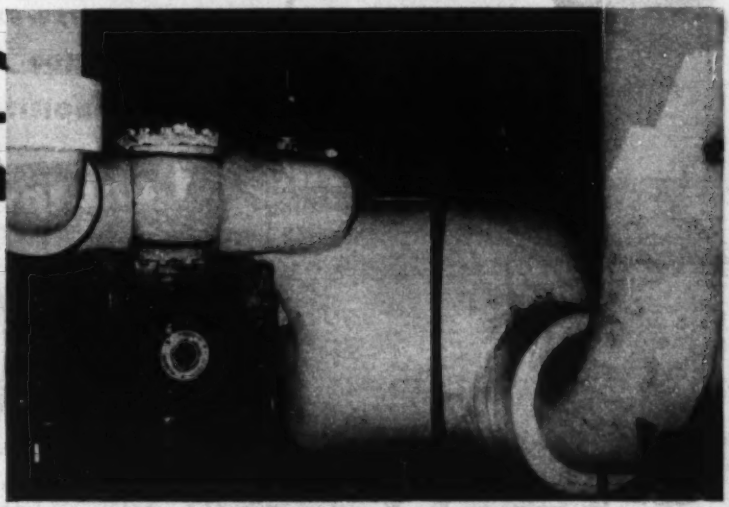
Standard Range Mechanical — Available in all sizes to suit load and capacity requirements.

Enco Standard Range Mechanical Atomizer Gun
Enco Wide Range Steam Atomizer Gun
Enco Wide Range Mechanical Atomizer Gun
Enco Standard Atomizer Gun Support
Enco Gas Burning Gun
EC-483

THE ENGINEER COMPANY
75 WEST STREET, NEW YORK 6, N. Y.



For this new addition to their New York City power plant at East River and 14th Street...



(Above) View of recently completed annex to Consolidated Edison's power plant... another link in their gigantic expansion program. **(Right)** Close-up of J-M 85% Magnesia Insulation on boiler feed lines. It was expertly installed by the Asbestos Construction Company, Inc., an outstanding J-M Insulation Contractor.

CON EDISON SPECIFIES J-M 85% MAGNESIA PIPE INSULATION FOR MAXIMUM FUEL SAVINGS

Like all materials that went into the new power plant addition of New York's leading gas and electric supplier... the pipe insulation had to be the *best*. That's why Consolidated Edison Co. specified J-M 85% Magnesia... industry's No. 1 insulation for many decades and *still* the leader in its class.

J-M 85% Magnesia is the leading insulation on the market for temperatures up to 600F. It is bonded with asbestos fibers. This rugged insulation will not distort regardless of the length of time it stays in service. J-M 85% Magnesia fits snug and stays put. Heat savings, therefore, remain constant for the life of the equipment on which this insulation is applied.

For temperatures over 600F, J-M 85% Magnesia is used in combination with Superex*, a J-M insulation for service to 1900F. This double-layer construction, known as Superex Combination, eliminates through joints and protects the jacket against scorching. It also utilizes the higher heat resistance of Superex next to the hot surface, and the greater insulating value of J-M 85% Magnesia for the outer layer.

*Reg. U.S. Pat. Off.

Experience has proved that all insulations must be properly installed to pay maximum dividends. That's why Johns-Manville offers industry the services of experienced insulation engineers and installation contractors who have made a career of solving complex insulation problems. From coast to coast, these engineers and the contractor's highly skilled mechanics stand ready to combine their talents and give you an insulation job that will more than pay off your initial investment with maximum fuel savings through the years.

When you face your next insulating problem... remember that Johns-Manville is "Insulation Headquarters." Consult your near-by J-M Insulation Contractor... or write direct to Johns-Manville, Box 60, New York 16, New York. In Canada, write 199 Bay Street, Toronto 1, Ontario.

Skilled Applicators on the team of a J-M Insulation Contractor applying J-M 85% Magnesia to pipelines. Located throughout the nation, these contractors have had years of experience handling all types of installations. They know J-M 85% Magnesia and other J-M insulations as *quality* products, and take pride in applying them properly. Result: an insulation job that pays dividends through the years in maximum fuel savings.

Johns-Manville *FIRST IN* INSULATION

MATERIALS • ENGINEERING • APPLICATION

Money-saving helps for instrument makers!

THE BELLOWS ASSEMBLIES pictured here give you an idea of the many types we make—and we can give you more ideas that can make savings on *your* bellows assemblies requirements. For example, we will work with you to develop an assembly exactly suited to your needs. That's a specialty with us—has been for half-a-century. Then—our skilled personnel and ample facilities can relieve you of all production problems and worries. You save time, trouble and money.

If you need bellows assemblies for thermostatic devices . . . flexible connectors . . . expansion joints . . . pressure controls . . . hydraulic mechanisms or for other uses—we can help you. Write for helpful technical advice. Ask for idea-filled Catalog PK-1200.

FULTON SYLPHON DIVISION Knoxville 4, Tenn.

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What do you want in a drive

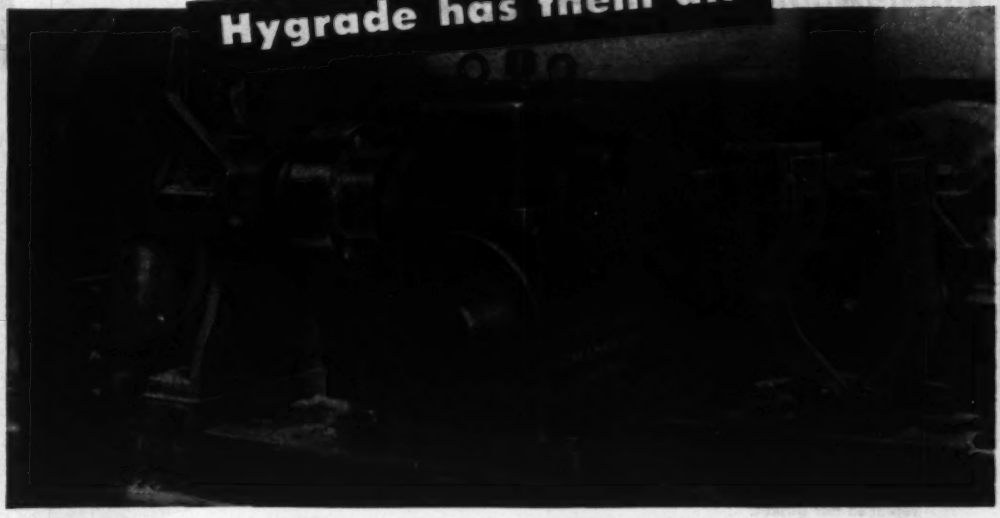
RUGGED STRENGTH

TROUBLE-FREE OPERATION

COMPACTNESS • ECONOMY

PRECISION ENGINEERING

Hygrade has them all



Engineered for those tough jobs in your plant where heavy duty demands rugged strength — ideal for any job where reliability, compactness, economy in operation are desired.

Foote Bros. Hygrade Drives are available in horizontal and vertical designs in a wide range of ratios up to 4108 to 1 — higher when required.

Hygrade Hytop Drives have wider, low-speed bearing span to accommodate long, unsupported vertical output shaft extensions, either upward, downward, or both. Advanced engineering, improved design, new techniques in manufacture, better control of material all make Foote Bros. Hygrade Drives ideal for your plant. Mail the coupon for Bulletin HGB.

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Please send me a copy of Bulletin HGB on Foote Bros. Hygrade Drives.

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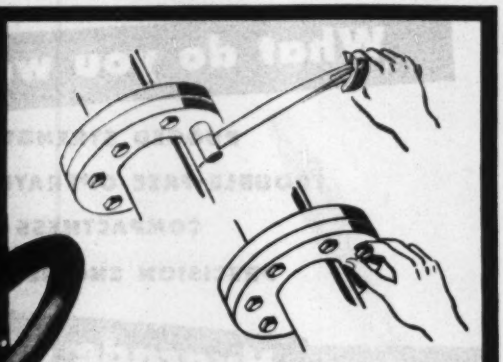
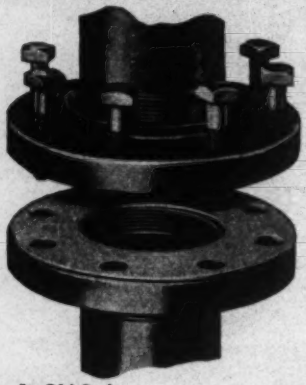
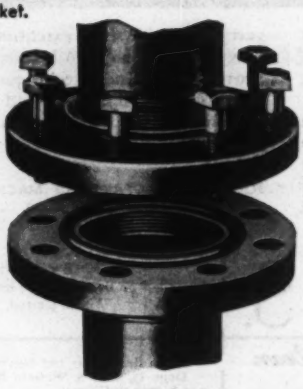
Results from designing for easier maintenance.....





1. Old Style
—with frequently replaced flat gasket.



2. New Style
—with permanent, leak-proof O-ring.

Why strain at bolts with a torque wrench when finger-tight pressure could do the job? Why not stop altogether the periodic checking and tightening necessary to compensate for the compression set of the usual flat gasket materials?

Using a LINEAR "O" ring gasket, you can achieve a perfect seal with metal-to-metal contact between flanges. And even better—that profit-eating overload designed into your line to compensate for the indeterminate sealing qualities of a flat gasket can be eliminated!

LINEAR "O" ring gaskets are easily installed without special assembly tools; further they cannot be unduly squeezed or damaged by over-tightening. Once installed they maintain a positive seal despite vibration or bolt stretch.

Take the guesswork out of the effectiveness of your flanged connections and standardize on one simple, efficient, maintenance-free method. Consult LINEAR for specific help with your sealing problems.

"PERFECTLY ENGINEERED PACKINGS"

LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILADELPHIA 35, PA.

Remember the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS, INC.

Streamline your purchase of welding fittings

Scrappy says, "Aid defense—more scrap today... more steel tomorrow."

Write Dept. F-8 for free booklet listing properties of pipe and welding fitting and flange materials.

JUST AS THE USE of welding fittings streamlines a piping system so does the standardizing on TUBE-TURN Welding Fittings streamline your purchasing operations.

The TUBE-TURN Welding Reducer, both in the concentric type shown here and the eccentric type, is available in a complete range of sizes, wall thicknesses and types of materials. This is another example of how the complete TUBE TURNS' line is designed to meet all your requirements. It covers over 4000 different items. Thus you can simplify ordering and deliveries for any piping job by obtaining all your welding fittings and flanges from one reliable source . . . your TUBE TURNS' Distributor. You'll find one in every principal city.

Be sure you see the double "tt"

TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

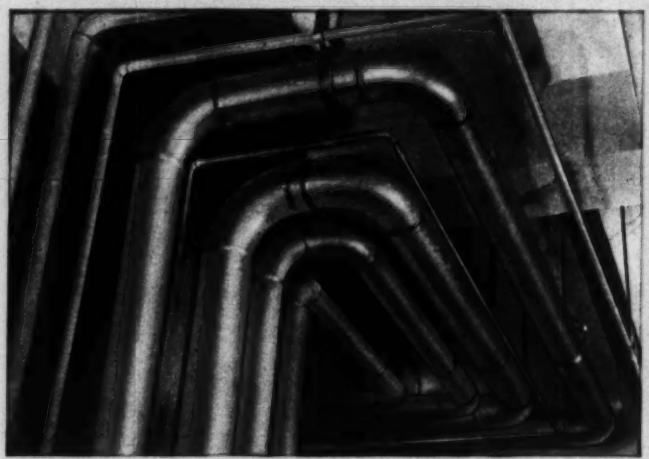
DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Houston • Tulsa • San Francisco • Los Angeles
TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO... A wholly owned subsidiary of TUBE TURNS, INC.

30 Stories of New Building Ideas ...includes maintenance-free welded piping

ALUMINUM COMPANY OF AMERICA's new 30-story office building in Pittsburgh is a pacesetter for construction ideas. Exterior walls are made of sheet aluminum. Windows pivot on vertical axes to simplify cleaning. Radiant heating and cooling panels in ceilings increase rentable floor space.

In keeping with this progressive design, a welded piping system, using TUBE-TURN Welding Fittings and Flanges, was specified. Thus piping, both aluminum and steel, will be leak-proof and maintenance-free. The variety of welding-fitting requirements posed no problem, since TUBE TURNS, INC. offers the world's broadest line of welding fittings and flanges—available in a wide range of types, sizes, and more than 40 different metals and alloys.

Alcoa's new office building. Architects: Harrison & Abramovitz. Assoc. Architects: Mitchell & Ritchey and Altenhof & Bown. Heating, Ventilating & Air Conditioning Sub-Contractors: Dravo Corp.; Plumbing Contractors: Sauer, Inc.



Corrosion-resistant aluminum lines for drinking, and hot and cold water supply saved critical copper. Note how welded lines, from 1" up, are fitted closely together, make for a neat installation. These lines will be insulated.

TUBE-TURN Welding Elbows, Tees, and Reducers used in steel piping for steam and hot water lines in basement. True circularity and uniform wall thickness of TUBE-TURN Welding Fittings expedited installation by insuring accurate fit.

Eight-inch steam line with 2" and 3" branches in fan room on roof. Use of welded system, with TUBE-TURN Welding Fittings, simplified piping design, gives streamlined appearance, eliminates maintenance problems.

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"TT" and "TUBE-TURN" Reg. U. S. Pat. Off.

TUBE TURNS, INC.

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Keep Heat Transfer Surfaces CLEAN...

SPECIFY

Vogt

SCRAPED SURFACE *Exchangers*

IF you are all "gummed up" with a tough heat transfer problem, Vogt Scraped Surface Exchangers will provide the answer. They have patented scraper elements which prevent fouling of the heat transfer surfaces and insure the highest rate of heat exchange between the product and the cooling or heating medium. The scrapers also continuously agitate the fluid and assist removal of solids from the unit.

DOUBLE PIPE EQUIPMENT is available in two types; EXCHANGERS, for cooling with water, brine, and cold filtrate, and for heating with steam or hot liquids; and CHILLERS, for use with volatile refrigerants such as ammonia, propane, and Freon. Both types have 8" jacket pipes and 6" inner pipes with scrapers.

SHELL AND PIPE TYPE UNITS are designed for use with volatile refrigerants and for heating fluids with steam or similar heating mediums. They consist of large welded shells each containing seven 6" scraped pipe sections.

Vogt Scraped Surface Exchangers serve profitably as oil chillers, crystallizers, and heaters in many processes in the petroleum and chemical industries. Their application to your heat transfer problems will receive the prompt attention of our Engineering staff.

Write for Bulletin PE-1

*DOUBLE PIPE UNIT. Drive and close-up of 12 section unit under test in our shop.

*SHELL and PIPE UNITS. Two of five units installed in a leading petroleum refinery.

*Patented

HENRY VOGT MACHINE CO.

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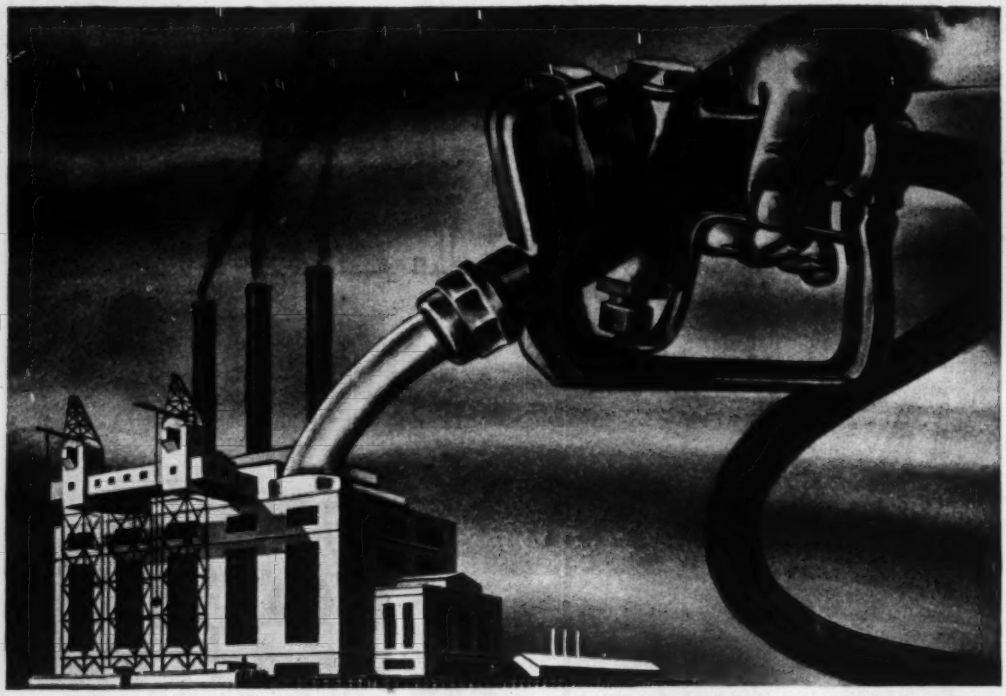

Refill For Plants That Need More "Go"

Are increased production loads demanding more than your plant can deliver? Here's how a company we know tackled this problem. The approach used may help you, too.

The demands of a power company called for such increases that a new station was needed. And because the area was so densely populated, tight operating economy was as much a "must" as peak productivity.

The boiler designed to meet these needs was built to deliver over a million pounds of steam an hour. In this design, steam scrubbers and cyclone separators literally cleaned the steam to protect superheaters from impurities that cause overheating and corrosion, and to help turbines keep peak efficiency. By making possible greater water level variations, in addition, this boiler permits larger, faster, *safer* load swings, while other new features assure longer life, lower operating costs, more power.

What *approach* assures equipment advances like these? Combined planning by engineering staffs of progressive Equipment Builders working with process engineers and materials suppliers. And for its knowledge of materials—as well as the design freedom, strength and rigidity of its specialty steel plate, heads and shapes—such builders turn to Lukens regularly.

Would you like them to help you? For their names, write us today, explaining your need. Manager, Marketing Service, Lukens Steel Company, 402 Lukens Building, Coatesville, Pa.

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WORLD'S LEADING PRODUCER OF SPECIALTY STEEL PLATE • PLATE SHAPES • HEADS • CLAD STEELS

Simplify Valve Inventories!

These "RENEWO" Valves Convert From Fullway To Plug Type!

Lunkenheimer "Renewo" Valves feature renewable and regrindable seats and discs . . . convertible from fullway to plug type. Stockroom investment and maintenance expense can be cut substantially by users who standardize on the line for all their 200-lb. bronze globe valve needs. A similar line is also available in the 300-lb. class.

"Renewo" Valves can be reground, renewed, or converted easily.

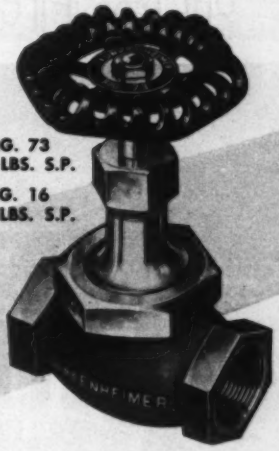


FIG. 73
200 LBS. S.P.

FIG. 16
300 LBS. S.P.

(FULLWAY TYPE) Seats and discs of hard, wear-resistant nickel alloy. Excellent for general service applications. One of the most popular valves ever designed.

(PLUG TYPE) Seats and discs of 500 Brinell Stainless Steel. Superior for severe erosive applications. Maximum resistance to effects of close throttling.

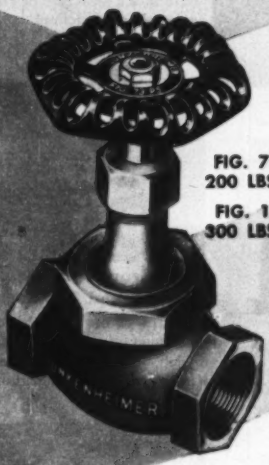


FIG. 73 PS
200 LBS. S.P.

FIG. 16 PS
300 LBS. S.P.

WRITE FOR Circular 577, which describes the "Renewo" line in detail. The Lunkenheimer Co., Box 360E Cincinnati 14, Ohio.

BRONZE • IRON • STEEL

LUNKENHEIMER

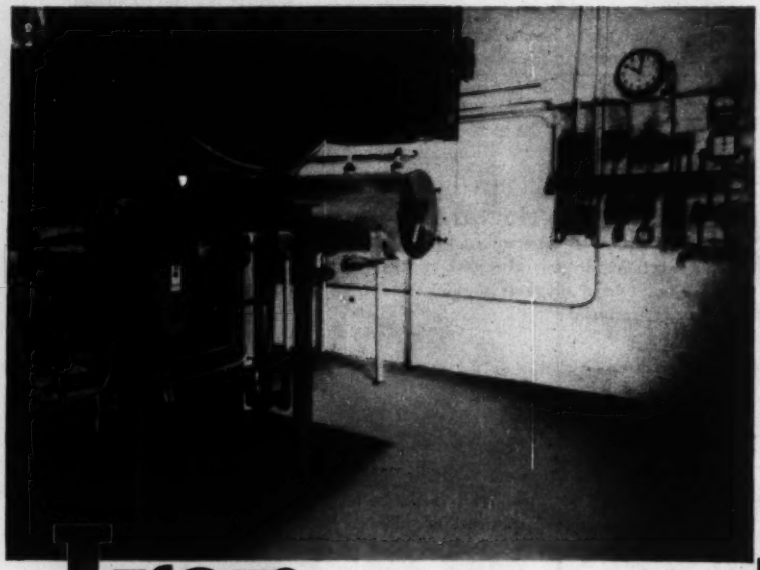
THE ONE *Great* NAME IN VALVES

L-952-5

We save $3800 a year with our Iron Fireman Rotary Oil Burner

says Mr. J. Mayberry, vice-president, Quality Mills, Inc. Mount Airy, North Carolina

"Our Iron Fireman Rotary Oil Burner has resulted in $1,800 per year savings in fuel cost over our previous firing method. In addition to this, other boiler room economies amount to approximately $2,000 per year. The efficiency of this unit has enabled us to save a great deal of time on many of our operations calling for quick steam."



The Iron Fireman Horizontal Rotary Oil Burner installed in the Quality Mills boiler is rated at 75 gallons per hour. It burns No. 6 oil and being fully automatic, requires little attention.

Iron Fireman

Horizontal Rotary Oil Burner

fires fuel oil of any weight with complete dependability

The changeable viscosity of heavy oils was heretofore the toughest problem in firing these heat-rich economical fuels. When warm, they flow freely—when cold, they are almost as sluggish as tar. The Oil Volumeter, with which the Iron Fireman burner is equipped, solves this problem of varying viscosities. Adjustable pistons feed a definite *volume* of oil with each stroke, regardless of the physical properties of the oil.

You save two ways. The heavy oils cost you less per gallon, yet you get up to 12% more Btu's than from lighter oils. The Iron Fireman Rotary Oil burner keeps a steady flame even when throttled down to less than 20% of capacity. . . Facilitates quick starting in cold boilers. . . Capacities up to 500 boiler h.p.

AUTOMATIC FIRING FOR HOMES, BUILDINGS, INDUSTRIAL PLANTS

IRON FIREMAN MANUFACTURING CO., 3267 West 106th St., Cleveland 11, Ohio.

Please send literature as checked:

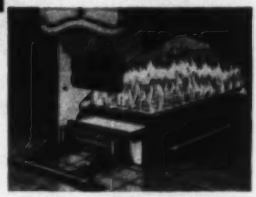
- ☐ Rotary Oil Burner
- ☐ Commercial Gas Burner
- ☐ Coal-Flow Stoker

Name_____

Address_____

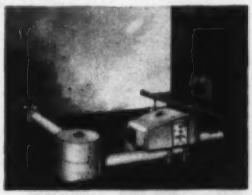
City_____ State_____

Mail coupon for literature and complete information.



Iron Fireman Commercial Gas Burner

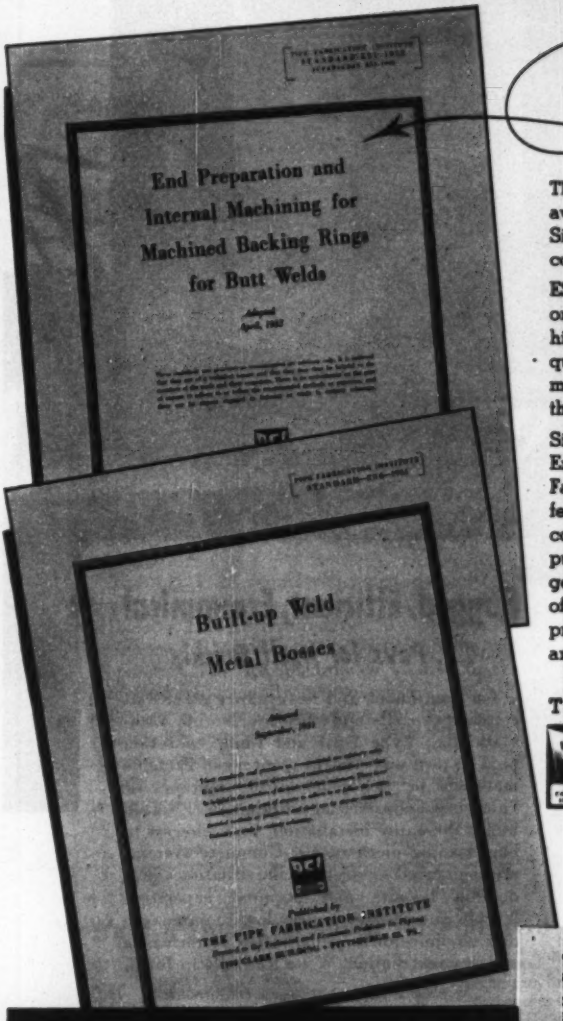
Vertical type has zone control for modulated firing. Other gas-saving models include Radiant Inshot, Ring-Type and combination oil-gas burner.



Iron Fireman Coal-Flow Stoker

Feeds coal direct from bin. No coal handling. Fuel and air supply synchronized for utmost efficiency Capacities to 500 boiler h.p.

MORE PFI STANDARDS for better pressure piping



just revised

The two PFI Standards shown here are now available to anyone concerned with pressure piping. Simply fill in the coupon below or write on your company letterhead; there is no obligation.

ES1-1952 is a late revision of the PFI Standard originally issued in 1948. It meets present-day high pressure and high temperature piping requirements . . . included are design changes that minimize the amount of weld metal required and the resultant shrinkage stresses in the weld.

Six Standards have now been published by the Engineering and Standards Committee of the Pipe Fabrication Institute to suggest standardized design features and procedures for designers, fabricators, contractors and users of pressure piping for all purposes. These Standards are often helpful in getting better piping and maximum value per dollar of cost . . . in saving time on the drawing board, in procurement of materials and during fabrication and erection of the job.

THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

811 CLARK BUILDING • PITTSBURGH 22, PA.

"Standardization ASSURES QUALITY and PROMOTES ECONOMY"

The Pipe Fabrication Institute
811 Clark Bldg., Pittsburgh 22, Pa.

Please send me without cost the PFI Standards illustrated here. If I want the other four Standards also available, I shall put a check mark here._____

Name_____

Title_____

Company_____

Address_____

Norblo
AUTOMATIC
Bag Type Dust Collection

Cutaway shows Norblo basic unit of 78 bags. Automatic shaking and bag cleaning, one unit at a time, insures full use of cloth area better than 99% of the time.

Rugged, Efficient, Economical
. . . *Pays for itself Quickly*

For continuous and heavy duty service at constant capacity and efficiency, Norblo Automatic Bag Type Dust and Fume collection pays its own way—in the recovery of valuable materials or the removal of injurious or "nuisance" industrial air contaminants. Norblo builds the entire installation, from blowers to bag-cleaning mechanisms. Complete systems are engineered to meet specific situations, production layouts and required capacities. Norblo engineering insures low maintenance and no shut-downs—guarantees performance of every installation. Write for Bulletin 164-3.

Norblo also builds centrifugal and hydraulic dust collectors, exhaust fans, cement air cooling systems and portable dust collectors.

THE NORTHERN BLOWER COMPANY

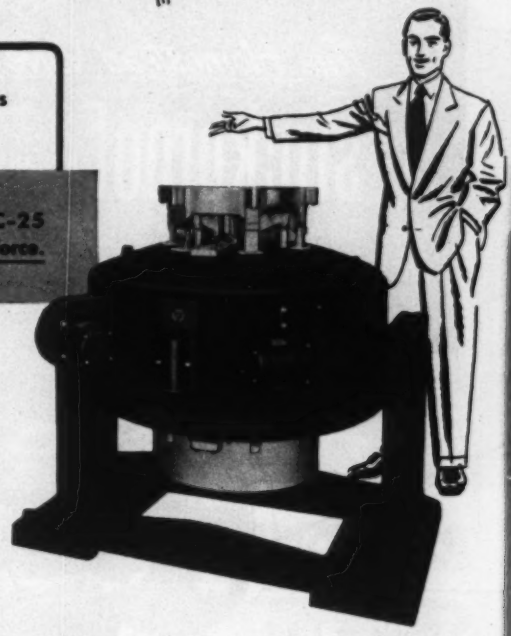
Engineered Dust Collection Systems for All Industries

6421 BARBERTON AVE. • CLEVELAND 2, OHIO

Vibration Engineering that solves your problems

PROBLEM: To perform vibration tests to MIL-E-5272 specification.

SOLUTION: The MB Model C-25 Vibration Exciter rated at 2500 lbs. force.

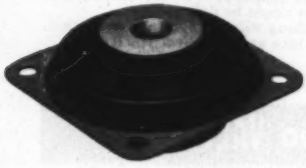


Shake testing gives a quick method of developing a product to withstand vibration. Such testing is vital for military equipment—and a good idea for any product. To meet this need, MB has applied its specialized vibration engineering to develop a range of shakers in various ratings for testing everything from electron tubes to airframes.

The big C-25 model illustrated develops large "brute forces" to satisfy specification MIL-E-5272. It has heavy duty capacity for a wide range of work, including fatigue testing. It features accurate, continuous control of force and frequency. Its control panel is available with an automatic cycling system for specific cycling tests called for in the MIL-E-5272 specification.

One of the largest and most dependable electromagnetic shakers available, the C-25 model is a good example of the quality of vibration engineering that has made MB "headquarters" for products to isolate, control, reproduce, detect, or measure vibration. More information on MB Vibration Exciters in Bulletin 1-VE-4. Write us.

Want a standard mount for vibration isolation in the special class?



With the Isomode* Type 17 Isolator, you not only conform to MIL-I-5432 specification but also get an unusual degree of isolation efficiency. It has equal spring rates in every direction. This means better control of all modes of motion. For details on this mount, write to Dept. 4.

*Trade Mark Reg. U.S. Pat. Off.

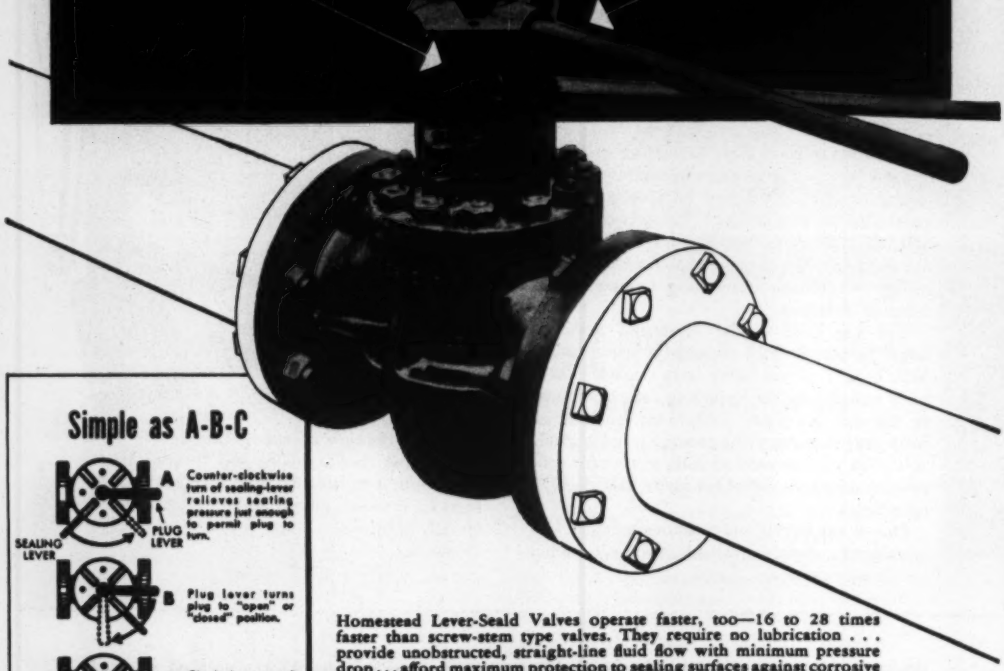
THE MB MANUFACTURING COMPANY, INC.
1060 STATE STREET, NEW HAVEN 11, CONN.

PRODUCTS AND EQUIPMENT TO CONTROL VIBRATION • TO MEASURE IT • TO REPRODUCE IT

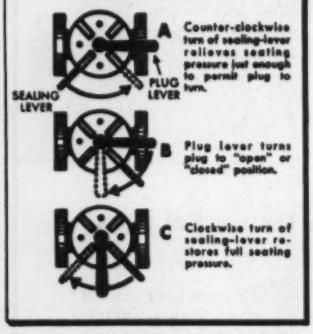
- **at all times**
- **under all conditions**
- **throughout its long lifetime of service**

This Homestead Valve will always work

it's **stickproof** because it's **lever-seald**



Simple as A-B-C


A
Counter-clockwise turn of sealing-lever relieves seating pressure just enough to permit plug to turn.
SEALING LEVER
PLUG LEVER
B
Plug lever turns plug to "open" or "closed" position.
C
Clockwise turn of sealing-lever restores full seating pressure.

Homestead Lever-Seald Valves operate faster, too—16 to 28 times faster than screw-stem type valves. They require no lubrication . . . provide unobstructed, straight-line fluid flow with minimum pressure drop . . . afford maximum protection to sealing surfaces against corrosive and erosive line fluids. And because only a quarter-turn is needed for full opening or closing, they are ideal for installation in restricted areas where operation of other types of valves might be difficult.

Next time you have damaged or sticking valves, replace them with Homestead Lever-Seald Plug Valves. Once you use them you'll never be satisfied with ordinary valves.

For complete information write for Valve Reference Book No. 39-3.

HOMESTEAD LEVER-SEALD PLUG VALVES

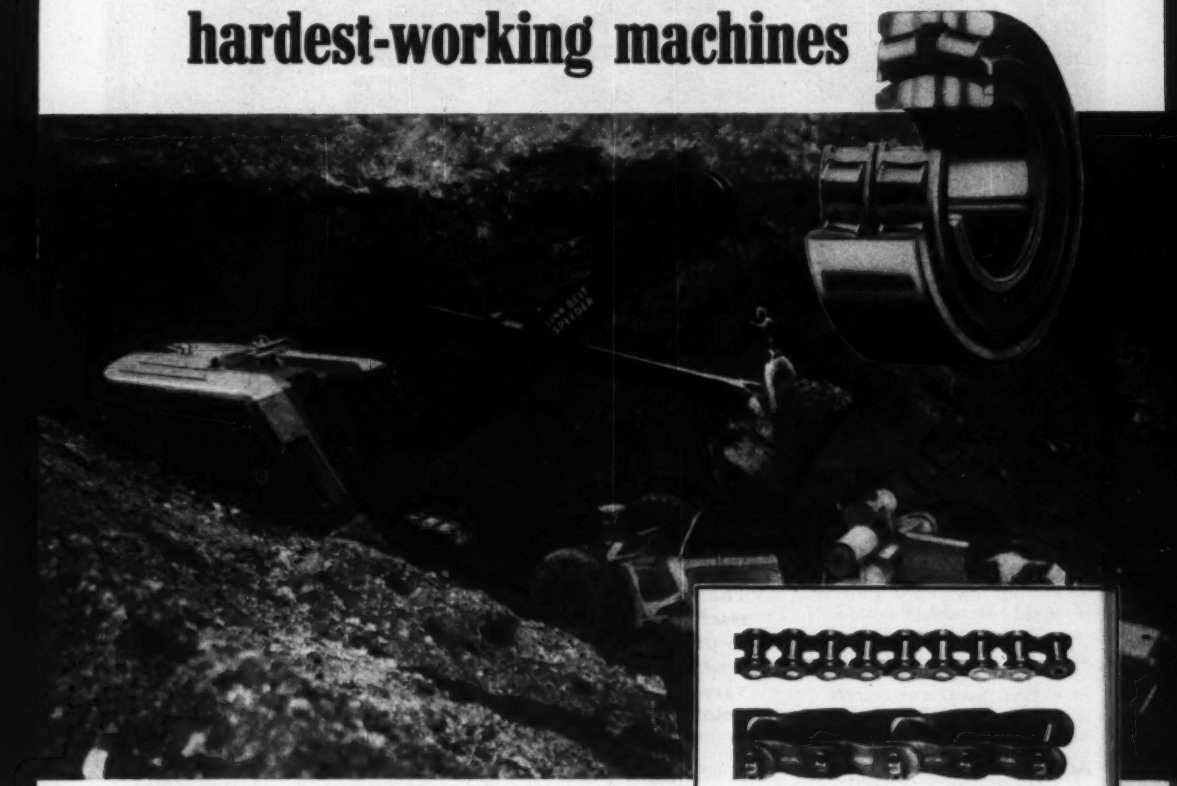
HOMESTEAD VALVE MANUFACTURING COMPANY

Serving since 1892

P.O. BOX 38 CORAOPOLIS, PA.

LINK-BELT research and engineering . . . Working for Industry

Keeping company with America's hardest-working machines



▲ Tough digging in an open pit mining operation puts heavy loads on the bearings in this powerful Link-Belt Speeder 1½-yard shovel. That's why Link-Belt roller bearings were chosen for the vitally important center pin, sliding pinion drum, swing and clutch shafts of this machine.

LINK-BELT Ball and Roller Bearings are the long-life answer for tough service

THE efficiency and life of any machine are dependent on the quality and accuracy of its bearings. That's why so many of America's top machine designers rely on Link-Belt's complete line of time-proved industrial ball and roller bearings.

Farm implement or oil field drilling rig . . . construction equipment, textile machinery — it's the same story on scores of industry's hardest-working machines. You'll find Link-Belt ball and roller bearings, as well as power transmission, conveying and processing equipment at work throughout industry. Wherever wheels turn or materials are moved — Link-Belt products help make America more productive.

Drive and conveyor chains

Ball and roller bearings

Link-Belt products widely used by major builders of construction machinery include drive and conveyor chain as well as mounted and unmounted ball and roller bearings. In both fields, Link-Belt builds a comprehensive quality line.

LINK-BELT

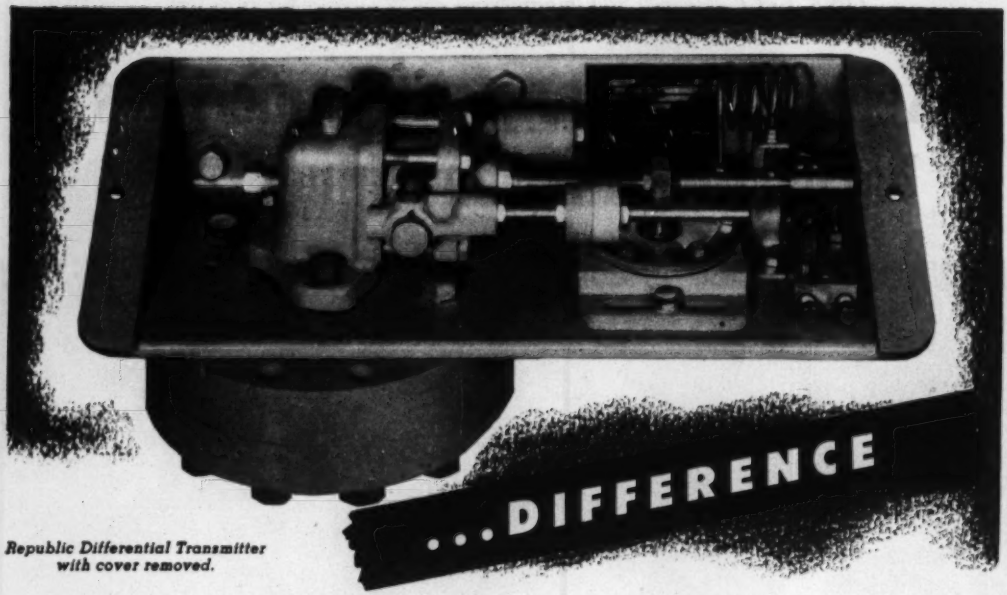
LINK-BELT COMPANY

Executive Offices:
307 N. Michigan Ave., Chicago 1, Ill.

Plants: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa), Sydney (Australia). Offices in Principal Cities.

12,070

ONE SOURCE . . . ONE RESPONSIBILITY FOR MATERIALS HANDLING AND POWER TRANSMISSION MACHINERY



Republic Differential Transmitter with cover removed.

Spells *PLUS* PERFORMANCE

The Republic Pneumatic Transmitter combines machine ruggedness with instrument precision to provide matchless performance in measuring flow, level, pressure or density of a wide variety fluids. By any or all of the following points, the Republic challenges comparison:

ACCURACY of the Republic force-balance principle is higher than can be consistently secured and maintained with any other method. 1/2 of 1% guaranteed.

TEMPERATURE variations of ambient atmosphere have negligible effect on the accuracy of the Republic transmitter.

CHANGES IN AIR SUPPLY PRESSURE do not affect the accuracy of a Republic transmitter to any significant extent. A 5 psi change produces an error of less than 1/10%.

CHANGES IN LINE PRESSURE—Republic differential transmitters are not affected by variations in line pressure. A patented and exclusive simple adjustment assures this protection.

SENSITIVITY—Due to the negligible motions required for complete operation of all parts, for a full scale change, no appreciable hysteresis results from reversal of direction of measurement change.

VIBRATION of any normal frequency has no effect on the Republic transmitter.

LEVELING—Since all parts are balanced, and no liquid is used for calibration, Republic transmitters need not be leveled exactly, and may be adjusted for installation in any position.

FOR TWELVE YEARS Republic Pneumatic Transmitters have delivered unmatched performance in every type of installation. Complete details of design and operation, plus numerous application suggestions are combined in Data Book, 1002. Send for your copy, today.

REPUBLIC FLOW METERS CO.

2240 Diversey Parkway, Chicago 47, Illinois

M. W. KELLOGG

American Gas & Electric Service Corp.
Boston Edison Co.
Central Hudson Gas & Electric Co.
Chaudronneries A. F. Smulders (Belgium)
Compania Argentina De Electricidad (Argentina)
Compania De Fuerza Del Suroeste De Mexico S.A. (Mexico)
Consolidated Edison Co. of N. Y.
Detroit Edison Co.
Dow Chemical Co.
Elektricitetsselskabet Isefjordvaerket (Denmark)
Ford Motor Co. of Canada Ltd. (Canada)
General Electric Co.
Hartford Electric Light Co.
Houilleres Du Bassin De Lorraine (France)
Houilleres Du Bassin Du Nord Et Du Pas-De-Calais (France)
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Long Island Lighting Co.
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Mexican Light & Power Co. (Mexico)
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New York State Electric & Gas Corp.
Niagara Mohawk Power Corp.
Palestine Electric Corp., Ltd. (Israel)
Philadelphia Electric Co.
Public Service Co. of Northern Illinois
Public Service Electric & Gas Co. of N. J.
Societe Anonyme John Cockerill (Belgium)
Societa Edison (Italy)
Societe Financiere De Transports Et D'Entreprises Industrielles (Sofina) (Belgium)
Societa Meridionale Di Elettricita (Italy)
Sociedad De Electricidad De Rosario (Argentina)
Union D'Electricite (France)
United Illuminating Co.
Westinghouse Electric Corp.
West Penn Power Co.
Wisconsin Public Service Corp.

M KELLOGG W

What happens to power piping here is vitally important . . . *because*—

The necessity for heat treating high-temperature, high-pressure alloy power piping, after both bending and welding, is an accepted fact. But it is the *means employed* that determine the ultimate quality of the material.

Take *this* piping scheduled for one of the larger U. S. utility plants. It has been fabricated into sub-sections by experienced Kellogg benders and welders . . . men who have produced the critical piping for power stations putting out *more than six and a quarter million KW's.*

But all this skill *can* be wasted in the furnace during heat-treating, if specific procedures are not meticulously followed. In the first such treating step, ferritic piping is *normalized* or full-annealed to homogenize the grain structure, after it has been hot bent to the desired shapes.

Normalized piping must then be *tempered*—by reheating and subsequent cooling through a carefully controlled cycle. This eliminates undesirable hardness caused by the formation of martensite during the rapid cooling while normalizing.

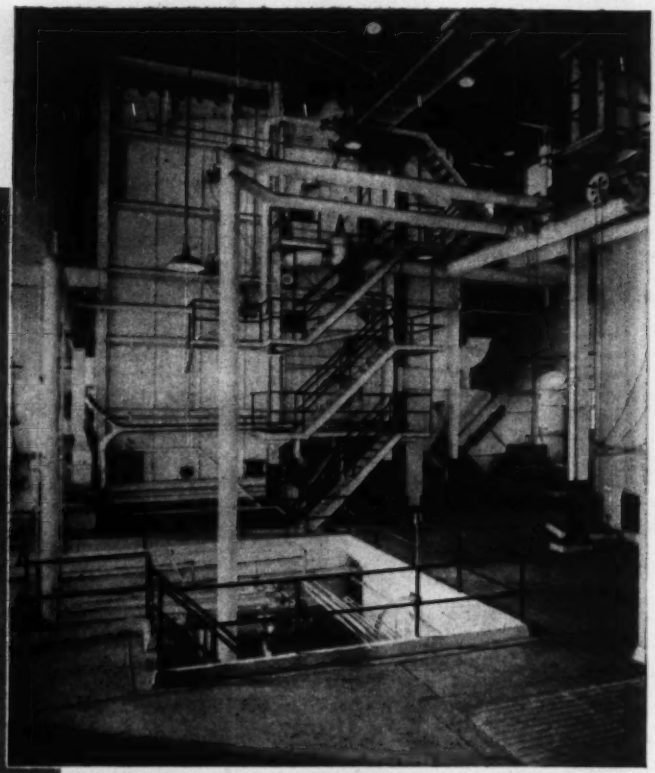
When normalized and tempered piping has been welded, it must again enter the furnace for *stress relieving* of the weld areas. During this operation, any substantial variation from specified temperatures may produce differences in hardness between the weld areas and surrounding metal — greatly increasing the possibility of operating failures.

To assure that utility piping is free of such potential problems, Kellogg's Metallurgical Lab sets heat treating procedures for each assembly . . . and to guarantee adherence to those procedures Kellogg furnaces are extensively instrumented. Laboratory supervision of shop practices such as these is one of the *means* that guarantee quality when you specify Kellogg power piping.

OTHER FABRICATED PRODUCTS including:
Pressure Vessels . . . Vacuum Vessels . . . Fractionating Columns . . . Drums and Shells . . . Heat Exchangers . . . Process Piping . . . Bends and Headers . . . Forged and Welded Fittings . . . Radial Brick Chimneys

for 51 years an integral part of industrial progress!

The M. W. Kellogg Company (A Subsidiary of Pullman Incorporated)
New York, Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London and Paris.



Sweet Words From Sugar Specialists

Recently an official of this large sugar refinery wrote us:

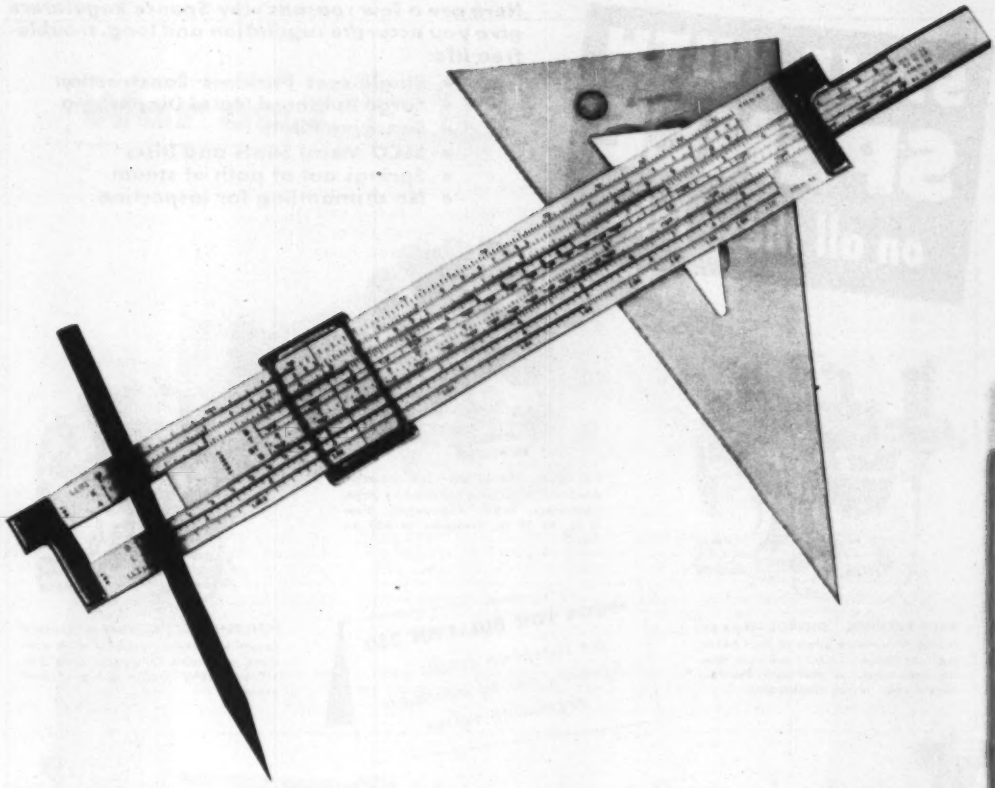
"We are all very proud of this installation and know that our boilers will meet the high standard of efficiency set by Erie City Boilers. Your personnel should be complimented for the fine workmanship that went into these boilers and the efficient manner in which our order was handled and scheduled through your shop.—This indicates good teamwork in your organization."

Yes, it takes good teamwork by all parties concerned to build good boilers, so whatever your steam requirement consult Erie City, for you can depend on Erie City steam generating equipment.

ERIE CITY

ERIE CITY IRON WORKS • *Erie, Pa.*

STEAM GENERATORS • SUPERHEATERS • ECONOMIZERS • AIR PREHEATERS
UNDERFEED AND SPREADER STOKERS • PULVERIZERS



You'll find classmates—and a future—at Boeing!

Men from more than 120 top engineering schools are building rewarding careers at Boeing. So chances are, you'd be working with some of your classmates here. And you'd be a member of an Engineering Division that has earned world-wide renown for its trail-blazing contributions to both military and civil aviation.

If that's the kind of engineering prestige you'd like to enjoy, look into Boeing opportunities. This company has been growing steadily for 35 years. It provides the finest research facilities in the industry. It offers you work on such exciting projects as guided missiles and the fastest known bomber in the world: the B-47 six-jet medium bomber, as well as the still-classified B-52 eight-jet heavy bomber.

There are opportunities at Boeing for experienced and junior engineers in all fields, for aircraft

- **DESIGN**
- **RESEARCH**
- **DEVELOPMENT**
- **PRODUCTION**
- **TOOLING**

also for servo-mechanism and electronics designers and analysts, and for physicists and mathematicians with advanced degrees.

You can work in Seattle, in the Pacific Northwest, or in Wichita, Kansas. Boeing provides a generous moving and travel allowance, gives you special training, and pays a good salary that grows with you.

You'll be proud to say, "I'm a Boeing engineer!"

Write today to the address below, or use the convenient coupon.

JOHN C. SANDERS, Staff Engineer—Personnel
Dept. M-8
Boeing Airplane Company, Seattle 14, Wash.

Engineering opportunities at Boeing interest me. Please send me further information.

Name _____

Address _____

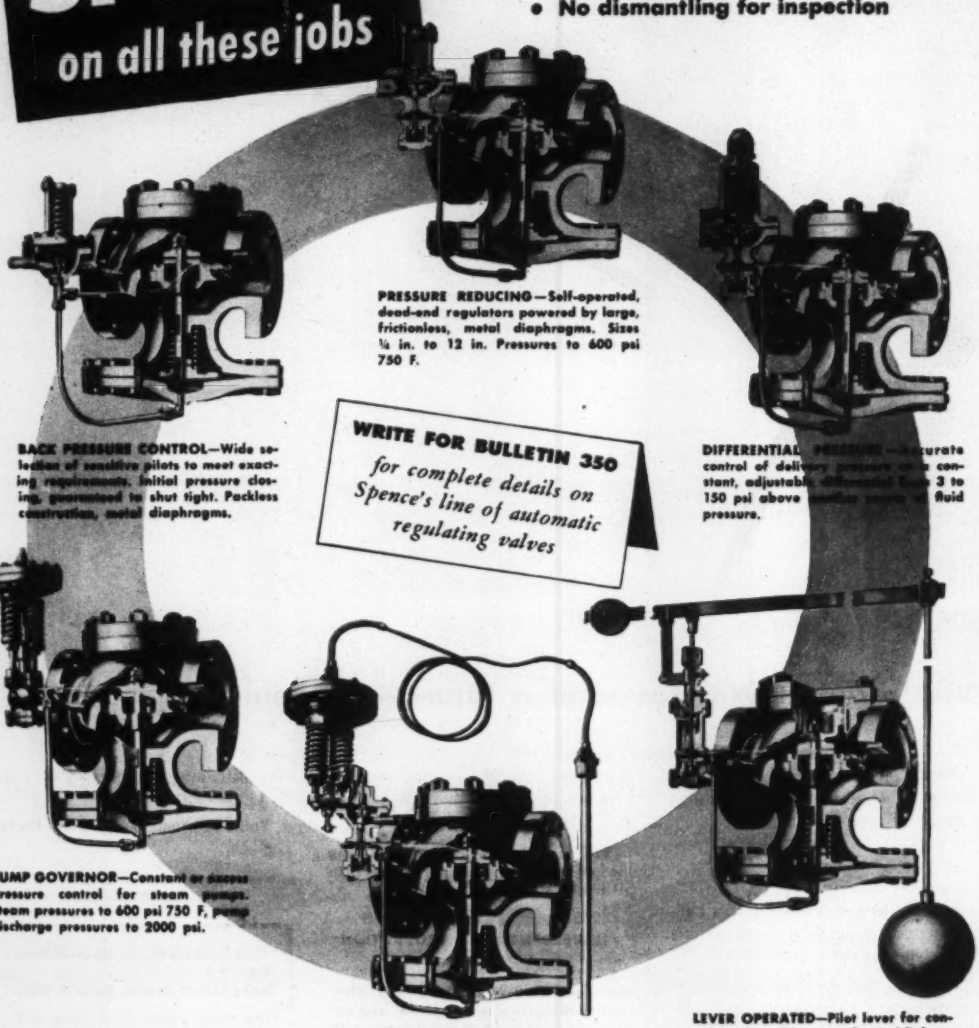
City and State _____

BOEING

SAVE WITH SPENCE on all these jobs

Here are a few reasons why Spence Regulators give you accurate regulation and long, trouble-free life:

- **Single-seat Packless Construction**
- **Large Balanced Metal Diaphragm**
- **Sensitive Pilots**
- **SECO Metal Seats and Discs**
- **Springs out of path of steam**
- **No dismantling for inspection**



PRESSURE REDUCING—Self-operated, dead-end regulators powered by large, frictionless, metal diaphragms. Sizes ¼ in. to 12 in. Pressures to 600 psi 750 F.

BACK PRESSURE CONTROL—Wide selection of sensitive pilots to meet exacting requirements. Initial pressure closing, guaranteed to shut tight. Packless construction, metal diaphragms.

DIFFERENTIAL PRESSURE—Accurate control of delivery pressure at a constant, adjustable differential from 3 to 150 psi above [illegible] fluid pressure.

WRITE FOR BULLETIN 350
for complete details on Spence's line of automatic regulating valves

PUMP GOVERNOR—Constant or stepped pressure control for steam pumps. Steam pressures to 600 psi 750 F, pump discharge pressures to 2000 psi.

TEMPERATURE REGULATING—Combined temperature and pressure control. No separate reducing valve required. Shuts tight, will not wiredraw or be damaged by overheating. Sizes to 12 in.

LEVER OPERATED—Pilot lever for connection by cable or mechanical linkage to floats or other devices. Slight actuator motion opens and closes main valve.

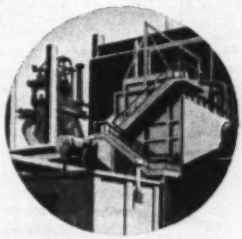
68-118

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

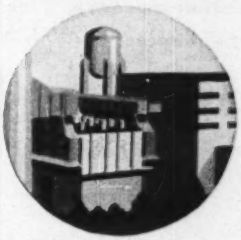
Spence

War on waste!

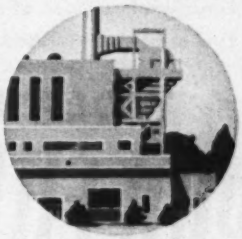
American industry is continually searching for new ways to stop waste and increase production and efficiency. A good example of this is the Koppers-Elex electrostatic precipitator. Shown below are a few typical ways industry uses them to combat waste . . .



BLAST FURNACE GAS must be cleaned before it can be used as a fuel. Koppers-Elex electrostatic precipitators clean this gas to residuals as low as .002 grain per cubic foot.



FLUE GASES from recovery boilers in pulp mills contain valuable materials. Koppers-Elex electrostatic precipitators recover several hundred thousand dollars worth of these materials yearly.



FLY ASH from power plants and factories may drop a blanket of dust extending three to five miles. Koppers-Elex electrostatic precipitators stop this nuisance and preserve public good will.

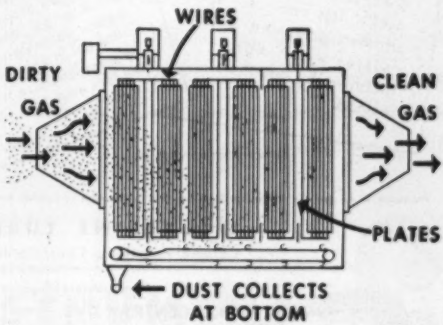
Guaranteed: All Koppers-Elex electrostatic precipitators are guaranteed to equal or better (under tests made by your own personnel) any efficiency or residual content you specify.

ENGINEERS! You should know about these six design features of Koppers-Elex electrostatic precipitators!

KOPPERS has made sweeping improvements in electrostatic precipitator design! For example, double chambers eliminate expensive by-pass systems and the resultant loss of materials during inspection or maintenance. And re-entrainment is sharply reduced because rapping is sectionalized.

Successive collection zones are separately energized to provide maximum voltage for highest collection. And because each field is, in effect, a separate precipitator, the outage of one field *does not stop* gas-cleaning action. In addition, completely enclosed and compact "package" mechanical or vacuum tube power packs simplify installation and operation.

Another exclusive Koppers feature is the drag scraper which provides continuous dust removal, eliminates plugged hoppers and prevents bothersome dust build-up. For detailed information on recovery, gas-cleaning or nuisance abatement results write today to: Koppers Company, Inc., Precipitator Dept., 228 Scott Street, Baltimore 3, Md.



If you have a gas-cleaning problem, write today to: Koppers Company, Inc., Precipitator Dept., 228 Scott St., Baltimore 3, Md.

KOPPERS®

Koppers-Elex ELECTROSTATIC PRECIPITATORS

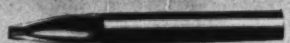
Tubular Parts now made with Fewer Operations

Tool cost reduced
Production and assembly time cut
Functional purpose of part often improved
Eye-appeal of finished part enhanced

by **WOLVERINE'S**

SPUN END PROCESS*

This copper tubular part was made in two operations: 1) Forming end to a semi-spherical shape by spinning; 2) The combined process of coining to a flat-end and piercing in punch press. The thickness of the finished end section is approximately double that of the original wall of the tube, making a substantial land for the soldering connections.



This formed copper tube—¾" O.D.—is an excellent example of a long accurate reduction, ending in an opening with a controlled I.D. The metal at the end is thicker than the wall of original tube. Inside of small opening is smooth.

A "long neck" type of reduction. A 1¾₆" tube has been reduced to ⅜₆" for a distance of 4¾". The beginning wall thickness is .022" and the reduced portion .045". This one-piece construction presented difficulties when manufactured by another method.

The Spun End Process brings another advancement to industry. In refrigeration, for example, it is now possible to produce accumulative driers that: 1) Keep moisture out of the refrigeration system; thereby reducing costs; 3) Prevent chances of plug-up thus making it less susceptible to pressure drop; 4) Obviate possibility of silica gel coagulating; 5) Assures against deterioration of unit by enclosing silica gel in supported mesh bag. We now produce accumulator driers in the following sizes: 15, 20 and 30 gram.

A PATENTED PROCESS RE. 22465

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario.

LET'S MENTION A FEW OTHER PRACTICAL END TREATMENTS

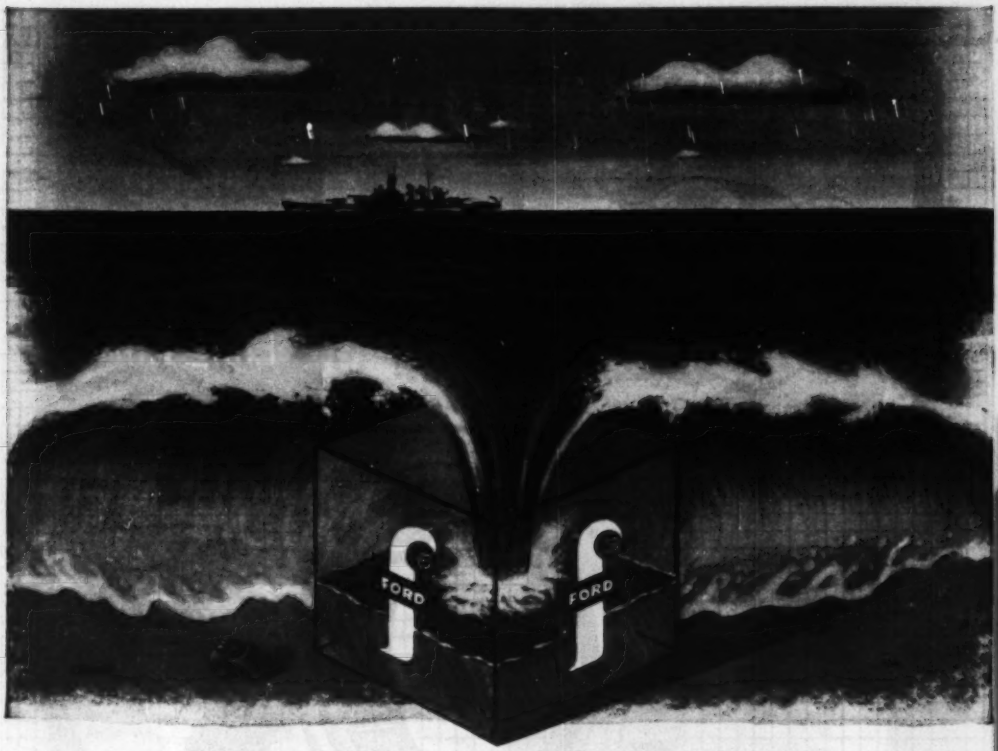
- Reduced opening, wall thickened and turned back inside tube.
- Round end, threaded O.D.
- Round end, threaded I.D.
- Reduced opening, long neck
- Round end with clevis
- Square end, open
- Reduced opening, short neck
- Spherical closure wall slightly heavier on end.
- Conical closure
- Reduced opening, no neck

Perhaps you have, or contemplate, a part that could be produced more economically by this modern process. Would you like a copy of our new Spun End Tube Brochure?

WOLVERINE TUBE DIVISION
Calumet and Hecla Consolidated Copper Company
INCORPORATED
Manufacturers of tubing exclusively
1437 CENTRAL AVE. • DETROIT 9, MICH.

PLANTS IN DETROIT, MICHIGAN AND DECATUR, ALABAMA
Sales Offices in Principal Cities

Export Department, 13 E. 40th St., New York 16, N. Y.



We put the ocean in a box...

In addition to the many complex problems solved by Ford for the Military Services there have been less complicated ones such as "bench-testing" a top-classified mechanism by using input signals to simulate the motion of a ship on the open sea. Ford produced these signals within the limited confines of a box.

Whatever the problem in intricate computing devices, no matter how simple or complex, Ford has the engineering "know-how" for its successful solution. For 37 years, Ford has *pioneered* in the field of nationally important automatic equipments with a record of outstanding success.

That is why Ford Instrument Company is usually considered *first* to research, develop, design and produce mechanical, hydraulic, electro-mechanical, and electronic instruments and components for specialized military and industrial applications.

If you are a qualified engineer—either experienced on automatic equipment design or a recent graduate—and are interested in your Tomorrows, consider Ford today. Write for information.

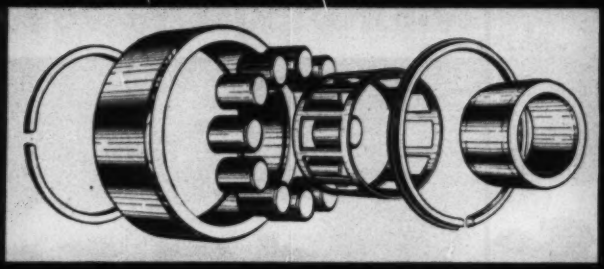
FORD INSTRUMENT COMPANY

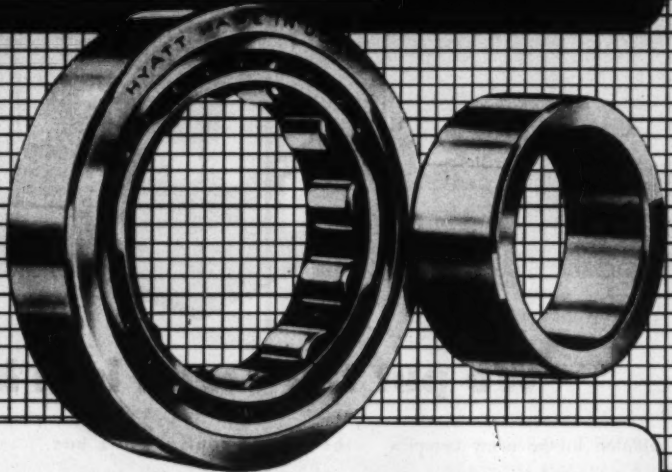
DIVISION OF THE SPERRY CORPORATION

31-10 Thomson Ave., Long Island City 1, N. Y.

FORD

HYATT HY-LOADS . . . for Capacity Separability and Long Life





IN THE family of Hyatt Hy-Load Roller Bearings is the popular A-TS type, one of the separable inner race, high-capacity cylindrical roller bearings made in two diameter series, wide and narrow widths, to standard boundary dimensions.

Separable parts are freely interchangeable. Any inner race will fit any roller assembly of the same piece number, permitting non-selective fitting after preassembling the two bearing parts in separable machine elements.

Interference fit of the inner race makes it virtually an integral part of the shaft. No accessory device is required to hold it.

A straight cylindrical inner race permits lateral expansion of the shaft through the bearing in applications where this is an important consideration.

May be applied with the rollers operating directly upon the shaft to utilize larger shaft diameter or bearing of smaller size, thereby gaining greater shaft rigidity.

For full information about the "A-TS" and other Hyatt Hy-Load Roller Bearings, write for Hyatt Catalog 547. Hyatt Bearings Division, General Motors Corporation, Harrison, N. J.

HYATT ROLLER BEARINGS

TERRY

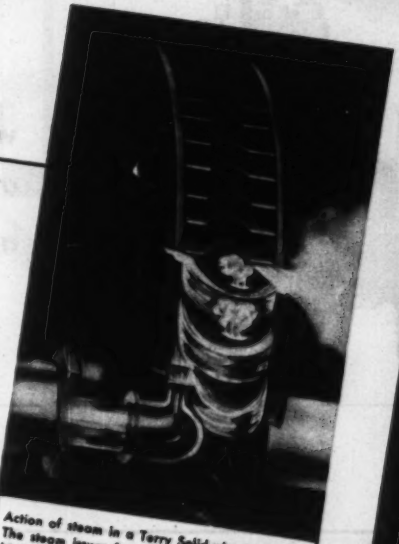
THIS TURBINE WHEEL

has no parts to loosen or work out

The rotor of the Terry Solid-wheel Turbine is a single forging of special composition steel, in which a series of semi-circular buckets is milled. There are no separate parts to become loose or work out.

The power-producing action of the steam takes place on the curved surfaces at the back of the buckets. Hence, wear of the blades is of little consequence, as it does not materially affect horsepower or efficiency. There is practically no end thrust since the steam enters and leaves the wheel in a direction at right angles to shaft.

This is only a small part of the story of the many advantages of the Terry Solid-wheel Turbine. Write for complete details.



Action of steam in a Terry Solid-wheel Turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket where its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized.

THE TERRY STEAM TURBINE CO.

TERRY SQUARE, HARTFORD 1, CONN.

TT-1189

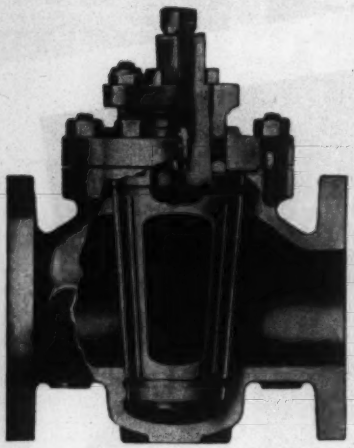
Memo

Send for a copy of bulletin S-116 which describes the many advantages of the Terry Solid-wheel Turbine.

WALWORTH

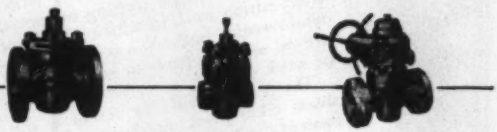
Lubricated

Plug Valves



for TOUGH assignments

where tight shut-off...
and easy operation
are "MUSTS"



Walworth Lubricated Plug Valves Offer These Advantages

- Complete surrounding of ports with resistant lubricant affords positive seal against leakage.
- Lubricant grooving system assures ease of operation — tight shut-off — greater protection against corrosion.
- Body and plug fully protected by lubricant from attack by line fluids.
- Quarter turn opens or closes valve.
- Made in a complete range of sizes ½" to 26" and for pressures from 175 to 5,000 psi., and for vacuum requirements.

For handling petroleum products, natural or manufactured gas, acids, alkalies, solvents, slimes, slurries . . . in fact for almost any hard-to-handle liquids—there's a Walworth Lubricated Plug Valve designed for the job.

Easy to operate, tight sealing, resistant to wear and corrosion, Walworth Lubricated Plug Valves assure long years of dependable service at low operating cost.

Walworth Lubricated Plug Valves are available in sizes ½" to 26" for pressures from 175 to 5,000 psi., and for vacuum requirements. For full details—prices, sizes, dimensions, and other pertinent data, see your Walworth distributor or write to:

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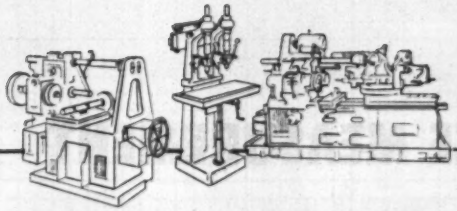

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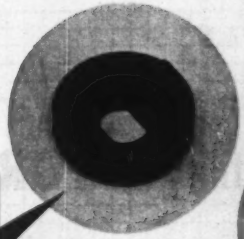

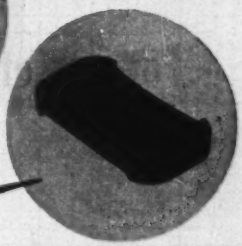

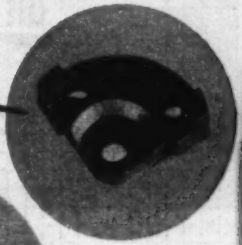

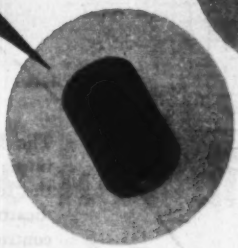

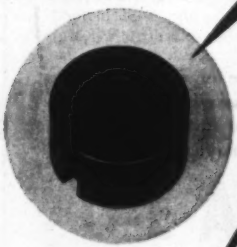

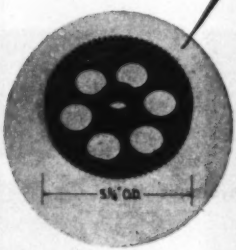

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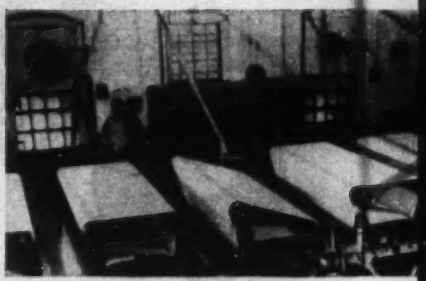
Why four plants chose four different G-E Adjustable-Speed Drives!

JACK & HEINTZ, INC. chose G-E *Speed Variators* because they wanted to increase production with rotating, adjustable-speed drive that could be operated from centralized control—still maintain good quality over a wide speed range.

◀**BUTTERICK CO. INC.** found G-E *ACA Motors* ideal for varying speeds over moderate range for offset presses. Here is the simplest, low-cost way to get stepless, adjustable-speed drive with a-c power, contains motor, control in one compact unit.



CRANE & CO., manufacturers of fine paper, selected G-E *Electronic Speed Variators* for paper machines—needed a 40 h.p. adjustable-speed drive that maintained rigid quality control, automatically, 24 hours a day, six days a week.

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*Junction Box Type Illustrated.

SEND FOR THIS NEW CATALOG for complete explanation of the unique THERMOSWITCH unit. Also ask for more detailed, illustrated discussions of the problems above. Fenwal engineers will be glad to help you solve your temperature control problems involving heat, humidity, radiant heat, pressure and other variables. Write Fenwal, Incorporated, 58 Pleasant Street, Ashland, Mass.

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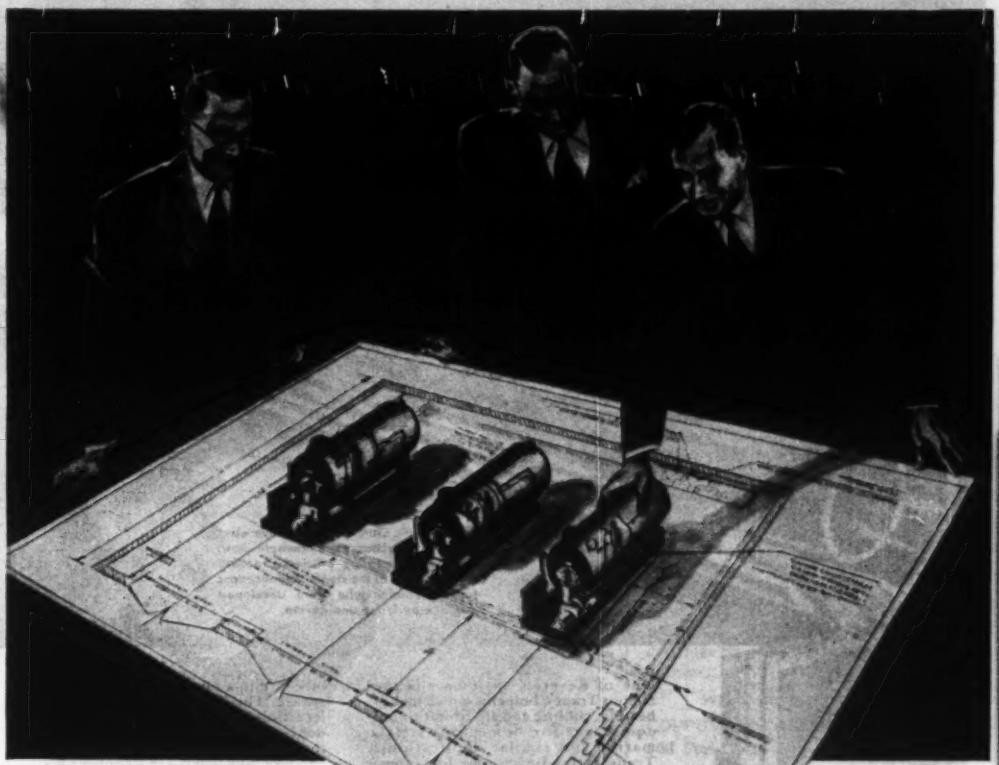
Electric Temperature Control and Detection Devices

SENSITIVE...*but only to heat*

Plan Your Boiler Installation this Way..



...to Balance Load Factor with Low Investment
...to Meet Present Needs and Future Expansion...

CLEAVER-BROOKS self-contained steam boilers are the answer to both present and future steam needs. You can install Cleaver-Brooks boilers in units to fit your present steam capacity requirements . . . keeping your investment at a minimum and your boiler efficiency at a maximum. Here's how it works . . .

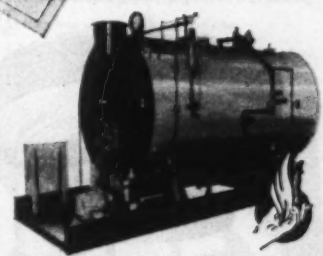
Your initial Cleaver-Brooks boiler installation is made in the size or capacity to fit your present steam load — this assures full use now at top efficiency and low capital investment.

As increased steam needs arise, additional Cleaver-Brooks boilers can be added to keep pace with your expanded requirements.

With this flexible program, you have the greatest return from your boiler investment — minimum original cost and lowest operating cost. Your boilers are always operating at maximum efficiency (80%) over the entire working range (30 to 100%).

Cleaver-Brooks self-contained boilers are ideal for multiple installations because of their compactness, low headroom requirements, fast installation, automatic operation, range of sizes. Available in standard models—15 to 500 hp.; 15 to 250 psi; gas, oil or combination gas and oil fired units.

Get all the story — write today for latest catalog.



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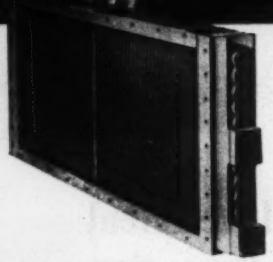
Trane Kinetic Orifice Tube. Orifices eject steam in direction of condensate flow, materially increasing efficiency, getting more heat out of the steam. Specifications for this copper tube were developed mutually by Trane and Revere.



Trane Type SDS Coil containing Kinetic Orifice Tubes, for heating use.

One of Revere's customers is the famous Trane Company, which makes heating, cooling and air-conditioning equipment for home, industrial, marine and similar applications. Trane relies on copper for tubes, because of high heat conductivity, resistance to corrosion and easy workability.

Like so many other Revere friends, Trane maintains close relations with the Technical Advisory Service, collaborating with it in developing specifications, studying specific corrosive conditions, and other matters of mutual interest.

For example, take the Kinetic Orifice Tube, a Trane design to overcome certain old handicaps found in the tube-within-a-tube steam distributing system. The Kinetic Orifice utilizes a jet action to accelerate the flow of condensate by discharging the steam in the direction of condensate flow. To produce such orifices in a copper tube requires a combination of shearing and flaring, and at first it was thought that the temper required for these operations would be so soft as to make it difficult to maintain the required straightness. However, study by both organizations finally developed a temper both workable and strong, now proved by several years of use.

If you are not now collaborating with the Revere Technical Advisory Service, perhaps it would be to your advantage to do so. Call Revere.

Trane projection-type Unit Heater employs copper tubes for both high pressure and low pressure work.

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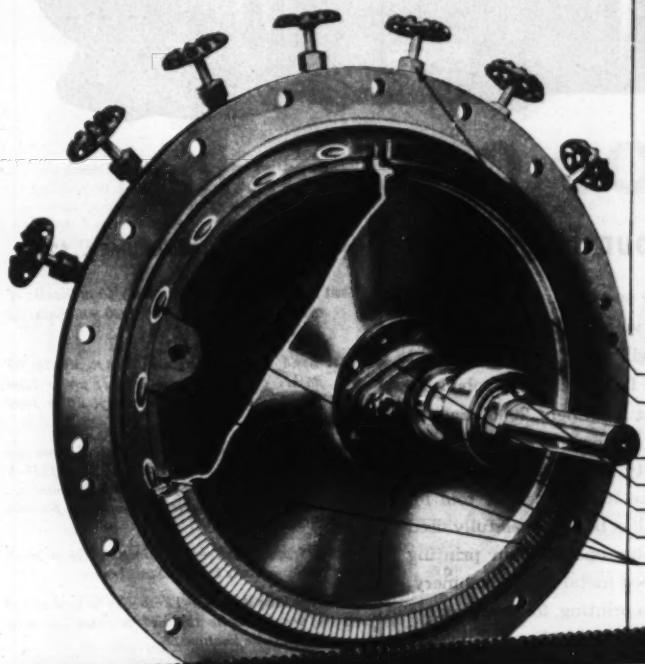
Coil for projection-type Unit Heater. The easy bendability of copper tube is a decided asset in forming the circular coils.

No other steam turbine offers you

SUCH VERSATILE STEAM NOZZLE CONTROL

The larger number of hand valves you see on a Coppus Steam Turbine promises you greater operating economy. At least 60% of the steam nozzles can be individually controlled to give maximum steam pressure in steam chest . . . a guarantee of best water rates at any load. Maintenance economy, too, is assured by the hard chromium plating of the shaft at the stuffing box. It provides the best possible smooth, non-corrosive surface for packing rings.



7 hand valves for efficient partial load operation, (20" turbine shown)

2 row velocity-stage turbine wheel with stainless steel turbine buckets — statically and dynamically balanced

30-40 carbon steel shaft

Oversized double row deep grooved ball bearing

Stuffing box with metallic packing ring

Heavy chrome plating of shaft through stuffing box

3 nozzles always open

Coppus Steam Turbines, Type TF, driving chemical transfer pumps at Celanese Corporation of America's Chemcel Plant

Coppus Steam Turbines ranging from 150 hp down to fractional in 6 frame sizes

MAKE TURBINE DOLLARS GO FARTHER

Why waste money buying turbines with higher horsepower ratings than you need? The higher the horsepower rating, the higher the price. Save money by selecting the Coppus Turbine size closest to your requirements from 150 hp down to fractional. And when you do, you save operating and maintenance costs, too. That's what these other Coppus features are designed to do: exclusive pilot operated excess speed safety trip supplementing constant speed governor; choice of metallic or carbon ring packing assemblies. Designs available for back pressures up to 75 pounds; replaceable cartridge type bearing housings. For full details . . .

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Stroboscopic study at low speeds, under 600 flashes per minute, requires an intense light which will produce on the eye a sharp, bright image that will stand out in contrast to the image seen under ordinary lighting. The Strobolume provides this *intense* light . . . a light 2000 times as intense as that provided by the ordinary stroboscope. The Strobolume's portability, compactness, accuracy and high intensity light source make it an excellent tool for a wide variety of jobs — It has been successfully used for the study and detection of faulty operation in printing presses, loom shuttles, slow speed metal shop machinery, for the registering of color in printing, for examination of crankshafts, camshafts or countershafts, as a light in single and multiple flash photography, and for the speed determination of any periodic, rotating, reciprocating, or vibrating motion under 3000 rpm.

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TYPE 1532-B STROBOLUME . . . $265

Short Flash — *Each flash lasts only 40 millionths of a second at high intensity; 20 millionths at low intensity position.*

Wide Speed Range — *High intensity: up to 60 flashes per minute, continuous; up to 1200 for short periods. Low intensity: up to 3000 per minute, continuous.*

Versatility in Operation — *Can be flashed from an external contactor, such as G-R Type 1535-A Contactor, or from Type 631-BL Strobotac . . . Cable with pushbutton for manual flashing is provided.*

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Safety Feature — *Overload breaker opens circuit when maximum safe operating time is reached.*

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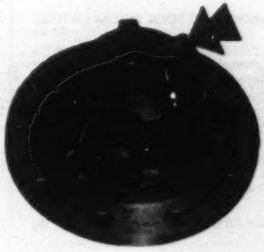
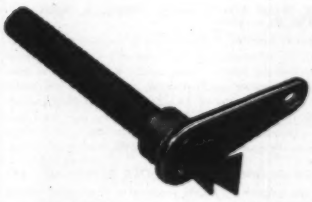
AS A SHAFT . . . Rollpin serves as an axle for the sparkwheel of a cigarette lighter. No riveting or threading necessary . . . faster assembly. Note flush, clean fit.



AS A DOWEL . . . Rollpin is used here to prevent rotation of a thrust bearing. No reaming, no special locking. Easily removed. Lowest possible dowel pin cost.

AS A CLEVIS PIN . . . here Rollpin holds firmly in clevis, permits free action of moving member. Rollpin application above is with the plate of a home workshop tool.



AS A KEY . . . Rollpin demonstrates its ability to do away with precision tolerances, in this heating system damper arm. Faster, cheaper and more satisfactory than usual assemblies.

AS A STOP PIN . . . in this application, Rollpin is shown in a ratchet wrench adaptor. With its light weight and high shear strength, Rollpin functions perfectly . . . cuts assembly costs.

AS A SIMPLE FASTENER . . . Rollpin replaces a set screw in pinning a gear to a shaft. Assembly time is shorter, service life longer. Vibration-proof flush fit. Easily removable.

YOUR IMPORTANT FASTENING JOBS

are cheaper . . . faster, with ROLLPIN TRADE MARK

Rollpin is a pressed-fit pin with chamfered ends. It drives easily into holes drilled to normal tolerances, compressing as driven. No reaming, no tapering, no extra assembly steps required. Rollpin fits flush, *locked* in place by the constant pressure it exerts against the hole walls. Can be inserted with automatic press, or by hand—removable with a drift or pin punch.

Rollpin is reusable again and again.

Elastic Stop Nuts with the famous red collar are another ESNA product

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MAIL COUPON TODAY. If your present operations or plans include the above applications—or set screws, rivets, hinge pins, cotter pins, pivot pins, taper pins—you can't afford to be without complete details on Rollpin. Write now—find out how much faster and cheaper Rollpin can do the job.

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Please send me the following free information on ESNA self-locking fasteners:

☐ Rollpin bulletin and sample Rollpins ☐ AN-ESNA conversion chart
☐ Elastic Stop Nut Bulletin ☐ Here is a drawing of our product. What fastener do you recommend?

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SMALL TOOLS AND MACHINE TOOL ELEMENTS

American Standards

Published by

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ACCURACY OF ENGINE AND TOOL ROOM LATHES, B5.16—1952. $1.00

This new Standard gives the tolerances to which industry is building 12 in. to 18 in., 20 in. to 32 in., and 40 in. to 72 in. lathes. Tests by which accuracy of the lathes may be determined are also given.

ADJUSTABLE ADAPTERS, B5.11—1937. 60¢

This standard gives the general dimensions of assembly, detail dimensions for adjustable adapter body, and general dimensions for adjustable adapter nuts, specifications for material finish, marking, and tolerances.

CHUCKS AND CHUCK JAWS, B5.8—1936. 55¢

Establishes controlling dimensions for all chucks from 6-in. to 36-in. diameter of both medium and heavy duty types, for an extra heavy series of chucks with serrated master jaws, for power-operated and hand-operated chucks of two-, three-, and four-jaw types.

CIRCULAR AND DOVETAILED FORMING TOOL BLANKS, B5.7—1948. 75¢

The 62 types of machines for which tool blanks and holders are provided are classified into six different groups of comparable stock capacities. Dimensions are given in this Standard for (a) circular tools with threaded mounting hole for groups 1, 2, and 3; (b) circular tools with counter-bored mounting hole for groups 4, 5, and 6; (c) dovetailed tools for all six groups, and (d) circular forming and dovetailed tool holders for all six groups.

DRILL DRIVERS (Split-Sleeve, Collet-Type), B5.27—1951 50¢

This Standard gives taper dimensions, general specifications, and the dimensions for 135 sizes of drill drivers along with the standard and optional taper number for each size.

INVOLUTE SPLINES, B5.15—1950. $2.00

Tables give dimensional and effective clearances, minor diameter fits, dimensions for both the flat root and fillet root types, basic measurements between and over pins, special pin measurements, and hob and broach dimensions. Provisions are made for allowable errors. Formulas are given for calculating pin measurements and torque capacities. Suggestions are included for placing dimensions and data on drawings.

INVOLUTE SERRATIONS, B5.26—1950. $1.00

Presents a uniform, easily fabricated set of serrations that can be made by several manufacturing processes. The pitches included are 10/20, 16/32, 24/48, 32/64, 40/80, 48/96, 64/128, 80/160, 128/256 complete from 6 to 100 teeth only for the first three. There are provisions for allowable errors and effective fits, new basic measurements between and over pins, and tables of maximum tooth space and minimum tooth thickness.

JIG BUSHINGS, B.56—1941, REAFFIRMED 1949. 50¢

Dimensions for: Press-Fit, Renewable-Wearing and Liner Bushings.

PUNCH AND DIE SETS FOR TWO-POST PUNCH PRESS TOOLS, B5.23—1950. 75¢

These dimensions are for back-post and diagonal-post sets. Tolerances established assure a high grade of tool which can be maintained commercially in respect to component parts and assembly. Dimensions cover die area, the die holder and punch holder thickness, shank diameters and lengths, guideposts and bushings, and removable punch holder shanks.

ROTATING AIR CYLINDERS AND ADAPTERS, B5.5—1932, REAFFIRMED 1949. 50¢

The four sizes of adapters standardized are: for the 3- and 4½-in. cylinders, the 6- and 8-in. cylinders, for all sizes of cylinders from 10 to 18 in., inclusive, for the 20-in. air cylinder or other power-operated device having a draw rod pull of 26,000 to 40,000 pounds. The length of stroke of the Standard cylinders, the position of the piston rod at the end of the stroke, the diameter of the piston rod, and the size of the tapped hole in the piston rod have also been standardized.

SINGLE-POINT CUTTING TOOLS AND TOOL POSTS, B5.22—1950. $1.25

Standard defines and illustrates the different classes of tools, their parts, and the angles at which they are used. Preferred dimensions are for: tool shanks, tool post openings, and lathe center height for solid tools and tool holders, six styles of sintered carbide tips (their commercial catalog numbers are also given), and the tips and shanks of tipped tools.

MARKINGS FOR GRINDING WHEELS, B5.17—1949. 50¢

Covering markings only, this Standard establishes a symbol for each of the most essential characteristics of a grinding wheel and arranges them in uniform sequence.

SPINDLE NOSES FOR TOOL ROOM LATHES, B5.9—1948. 85¢

These Spindle noses are for use on tool room lathes, engine lathes, turret lathes, and automatic lathes. Dimensions cover each size and type of nose; mating backs of chucks, face plates, and fixtures; and gages for checking important dimension on spindle noses and on back of chucks, face plates, and fixtures There are instructions for drilling balancing holes for Type A spindle.

SPINDLE NOSES AND ARBORS FOR MILLING MACHINES, B5.18—1943, REAFFIRMED 1949. 50¢

Provides the essential dimensions for ends of arbor and adapter and for spindle nose, also dimensions for draw-in bolt end.

STRAIGHT CUT-OFF BLADES FOR LATHES AND SCREW MACHINES, B5.21—1949 50¢

Dimensions here given are for the height, length, and thickness of the approved four types of blades. Sketches show optional shapes for cut-off blade stock.

T-SLOTS, THEIR BOLTS, NUTS, TONGUES, AND CUTTERS, B5.1—1949. 50¢

The primary purpose of this standard is to insure interchangeability. To accomplish this it recommends a width of throat greater than the nominal diameter of the bolt. It also provides an alternative standard having the throat width equal to the nominal diameter of the bolt. Other recommendations provide for the use of a stud of a smaller size than the T-bolt for the corresponding slot; that T-bolts, nuts, and slots be known by the diameter of the bolt; and for chamfering corners.

LIFE TESTS OF SINGLE-POINT TOOLS, B5.19—1946. 55¢

These test methods are for the appraisal of single-point cutting tools—for use on such machine tools as lathes, turret lathes, boring mills, planes, and shapers. These tests apply to speed, feeds, depth of cuts, shape and size of tools, Rockwell hardness, shape and size of test logs, etc.

TWIST DRILLS, B5.12—1950. 75¢

Provides dimensions for standard straight shank drills varying from 0.0135 to 2.000 in.; taper shank drills from ⅛ in. to 3½ in.; the corresponding drill lengths and flute lengths. Tolerances have been set on the various features of drills to provide interchangeability of products of different manufacturers in user's plants.

MACHINE TAPERS, B5.10—1943, REAFFIRMED 1949. 75¢

Presents (1) basic dimensions for 22 sizes of self-holding tapers; (2) detailed dimensions and tolerances for self-holding taper shanks and sockets classified as to (a) the means of transmitting the torque from spindle to shank of tool, and (b) the means of retaining the shank in the socket; (3) dimensions for steep tapers, and (4) dimensions and tolerances for the plug and ring gages applying to this series.

MACHINE PINS, B5.20—1947. 50¢

Sets up dimensions for the following types of pins: hardened and ground dowel pins, straight pins, ground dowel pins (not hardened), taper pins, clevis pins, and cotter pins. An appendix gives specifications for taper pins and a drill chart for the size of drill and number required.

MILLING CUTTERS, B5.3—1950. $2.25

Reflecting the developments in cutter design, tool material, and machine improvements are the 56 types for which dimensions are here given. Supplementing the dimensions are descriptive illustrations of the approved milling cutter and a glossary of terms.

REAMERS, B5.14—1949. $1.00

General dimensions of thirty standard types of reamers and related tools are presented along with the magnitude and direction of the tolerances including the number of flutes in the various types.

TAPS—CUT AND GROUND THREADS, B5.4—1948. $1.50

32 tables give the thread and general dimensions together with the working tolerances for nine types of taps. Supplementary material includes terminology and definitions and instructions for marking taps, dies, and other threading tools.

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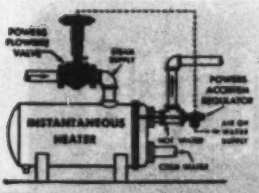

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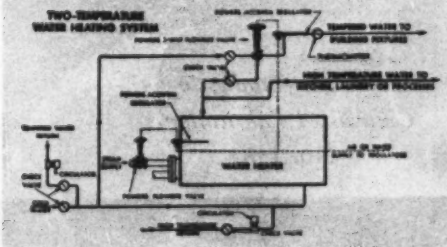

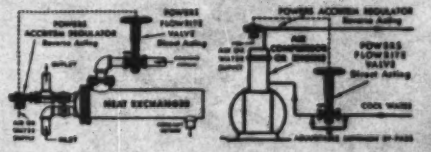

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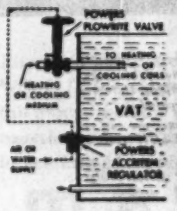

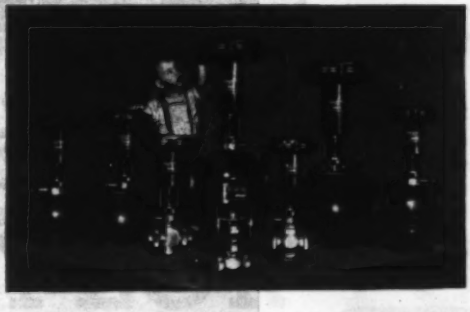

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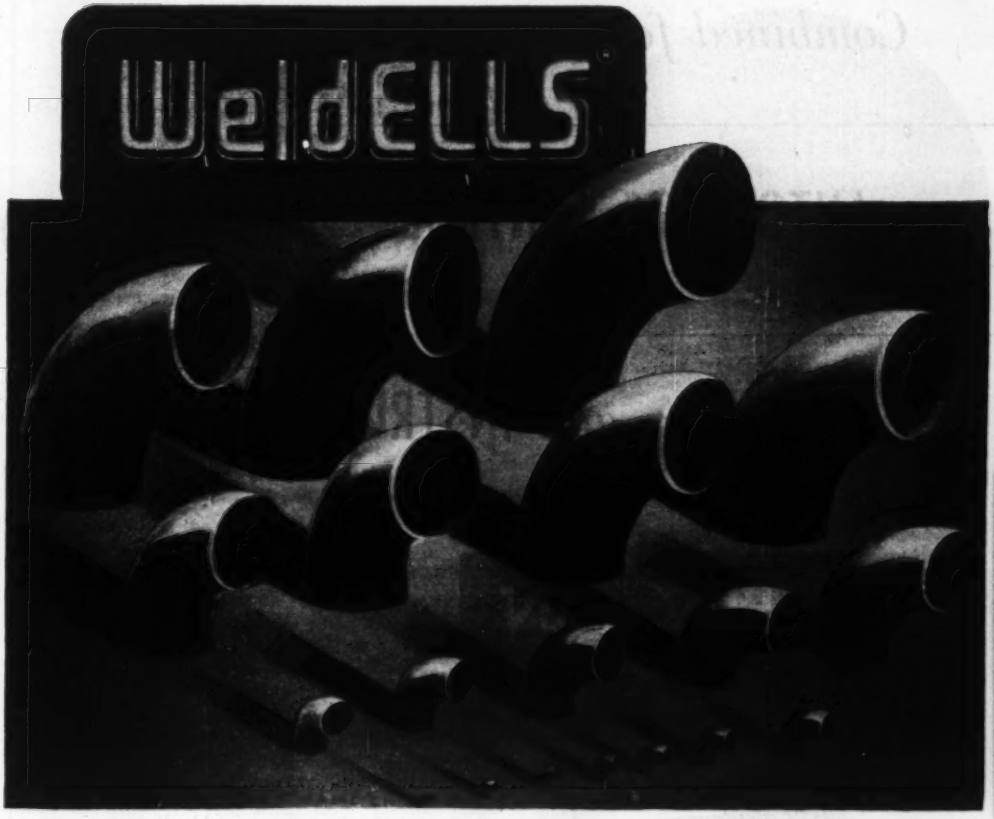

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Bancroft & Sons Company
Bigelow-Sanford Carpet Company
Burlington Mills Corp.
Cannon Mills Company
Celanese Corporation of America
Cone Mill Corp.
Congoleum-Nairn, Inc.
Dan River Mills
Goodall-Sanford, Inc.
Mohawk Carpet Mills, Inc.
Standard-Coosa-Thatcher Company
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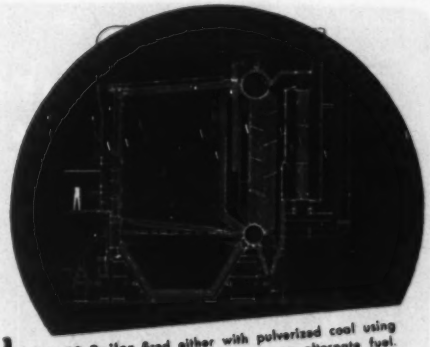
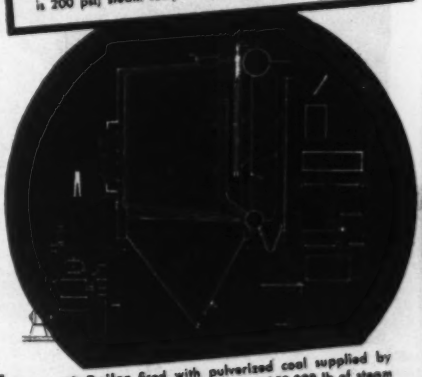
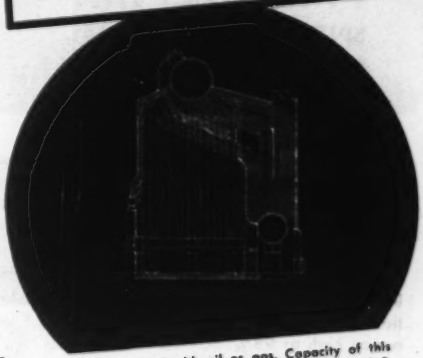


VU-50 Boiler fired either with pulverized coal using C-E Raymond Bowl Mills, or oil as an alternate fuel. Capacity is 100,000 lb of steam per hr. Steam pressure is 200 psi; steam temperature is 500 F.



VU-50 Boiler fired with pulverized coal supplied by C-E Raymond Bowl Mills. Capacity — 150,000 lb of steam per hr; steam pressure, 600 psi — temperature, 700 F.



VU-10 Boiler fired with oil or gas. Capacity of this unit is 40,000 lb of steam per hr at 420 psi and 600 F. VU-10 capacities range from 10,000 to 60,000 lb of steam per hr. They may also be fired by spreader, underfeed or chain grate stokers.

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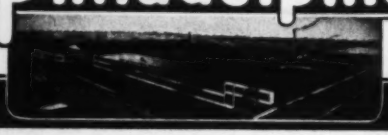

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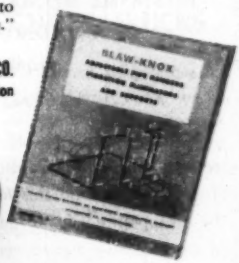

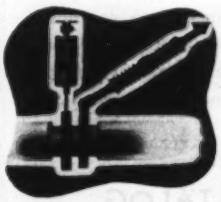

CATALOG NO. 51 *is of equal value whether you are planning a new piping installation or wish to correct the faults of an existing one. Please request it on your letterhead.*

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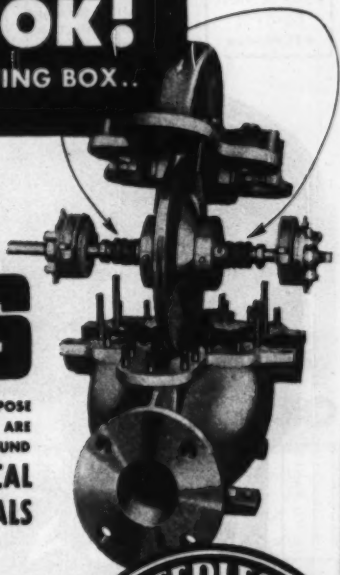

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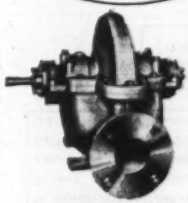

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Food Machinery and Chemical Corporation
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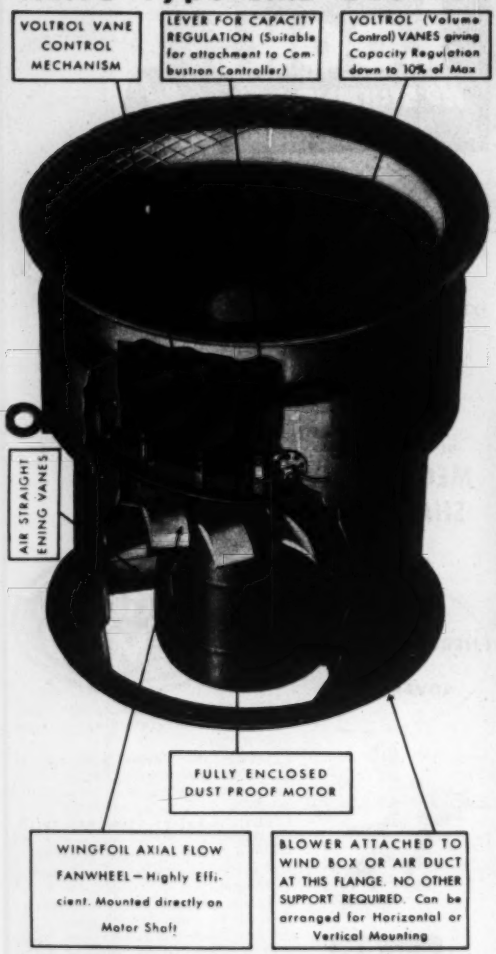
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VOLTROL (Volume Control) VANES giving Capacity Regulation down to 10% of Max
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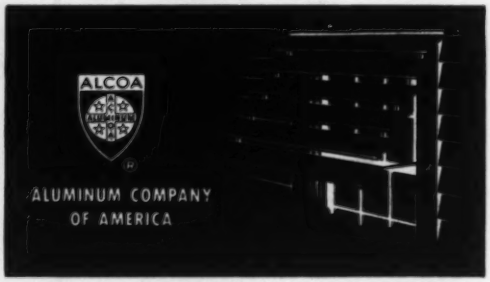

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published by

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- Lower operating costs

To increase the efficiency of your compressor, send us the name, bore, stroke and speed of your machine. Our detailed proposal will be sent without obligation.

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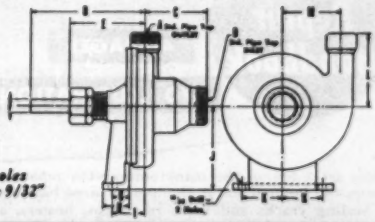
These pumps may be driven with a V belt pulley or directly connected to an electric motor by a flexible coupling. They are used for pumping fuel oil, gasoline, water, coolants, brines and many other liquids. The open impeller design permits the handling of a percentage of semi solids.

The 4G and 9G may be operated with a ¼ horsepower motor. The efficiency of a centrifugal design is increased greatly by increasing the r.p.m. of the shaft. The 1G requires but a 1/12 horsepower motor when operating at 3450 r.p.m.



**Foot holes in base 9/32"*

DIMENSION TABLE

No.	A	B	C	D	E	F	G	H	I	J	K	L	M
1G*	⅛	¼	2 1/32	3 5/16	2 5/32	5/16	5/16	⅝	7/64	1 13/16	1⅝	2 3/32	1⅛
4G	⅛	⅝	2 9/16	4 7/16	2 11/16	⅛	⅛	1	1¼	3¼	1⅛	2	2 5/32
9G	1	1¼	2 13/16	5 9/16	3 5/16	⅛	1 1/16	1 9/16	1⅛	3¼	1⅛	2⅝	2 3/32

CAPACITY TABLES

Pump No.	Speed	H.P.	Inlet	Outlet	Gallons Per Minute—Head in Feet							
					0	4	6	8	12	16	20	24
1G	1725	1/12	¼	⅛	2.00	1.05	0.10	—	—	—	—	—
1G	3450	1/12	¼	⅛	4.00	3.70	3.50	3.25	2.75	2.10	1.35	0.10
4G	1725	¼	⅝	½	10.75	7.50	4.00	—	—	—	—	—
4G	3450	¼	⅝	½	23.00	22.00	21.58	21.00	18.75	15.25	11.50	8.00
9G	1725	¼	1¼	1	35.00	32.66	31.66	29.50	26.00	21.66	15.00	3.50

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Seven of the nine sections for this Glossary are now available. Each lists terms peculiar to its field, those used in the field with a different sense or with different emphasis from what is most commonly understood in other connections, and terms used elsewhere in the same way but so infrequently as to be unfamiliar.

III	Reactor Engineering	$ .75
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• DEFINITIONS OF OCCUPATIONAL SPECIALITIES IN ENGINEERING

This occupational information book contains current and comprehensive data related to activities such as research, design, development, testing, procurement, production, construction, operation, administration and teaching, and to twenty-three engineering fields of specialization, including the special knowledge, duties, responsibilities and related techniques necessary. The definitions—approximately 500—were prepared by the ASME with the assistance of representatives of pertinent engineering societies.

1951 $2.50

• A CLASSIFIED GUIDE TO THE F. W. TAYLOR MEMORABILIA

This Guide was prepared to make accessible the late Frederick W. Taylor's articles, reports, books and personal notes at the Stevens Institute of Technology, Hoboken, New Jersey. It provides references to Taylor's life and work, the published articles, bibliographies, press clippings, reports on scientific management, and material pertaining to the details of the Taylor system as applied to various functions or management and production.

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• MANUAL OF CONSULTING PRACTICE

This Manual recommends the general basis for consulting work, classifies consulting services, deals with designation of mechanical engineering projects, cost of rendering service, types of service, basis for making charges, repetitive work, drawing and designs, patterns and confidential data.

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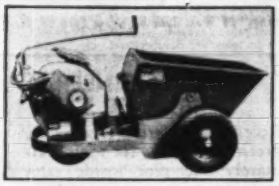

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MECHANICAL ENGINEERING

July, 1952 CARD INDEX Vol. 74, No. 7

Etiwanda—A Study in Over-All Steam-Station Economy, W. L. Chadwick and E. H. Krieg 543
Organizing Cost Reduction, T. C. Gary 551
The ASME Boiler Code
I Introduction—The Antecedents of the Code, A. M. Greene, Jr. 555
Conditioning of Natural Gas, J. C. Boehm 563
Selecting and Training Fork-Truck Operators, D. R. Holm 568
Incentives for Better Production Effectiveness, Phil Carroll 573
Editorial 541
Briefing the Record 575
ASME Technical Digest 589
Contents of ASME Transactions 594
Comments on Papers 595
Reviews of Books 600
ASME News 602
ASME Junior Forum 617
Engineering Societies Personnel Service 618

OPPORTUNITY ADVERTISEMENTS

If you desire capital or have it to invest; if you have a patent for sale or development; if you have on hand used machinery for disposal, or if you want such equipment; if you have copies of publications or a set of drawing instruments to dispose of; if you need help or want a position; in fact, anything to be offered that somebody else may want or anything wanted that somebody else may have—use a classified advertisement in the Opportunities Section.

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Additional Opportunities are offered in the display advertisements— on pages 49, 68, 99

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My Field of Engineering _____

My Street Address _____

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Address CA-3983, care of "Mechanical Engineering."

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LOCATE IN THE
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Please write us for complete information on career opportunities at North American. Include a summary of your education, background and experience.

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P.O. BOX 7258
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Six Pages of "OPPORTUNITIES" This Month . . . 128-133

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Address CA-3985, % "Mechanical Engineering."

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POSITIONS WANTED

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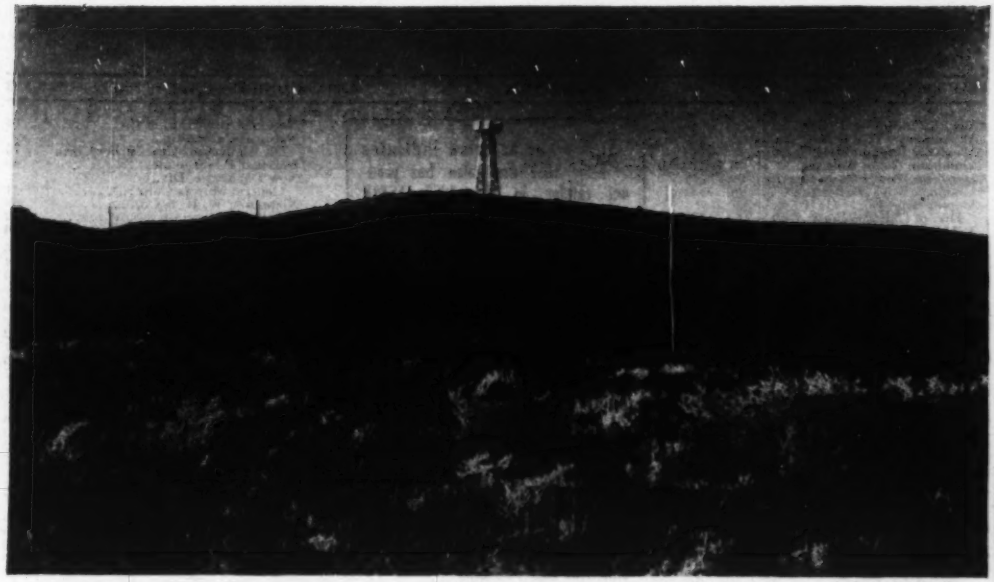

Radio-relay station at Evanston, Wyoming

a Watcher for lonesome places

Many of the Bell System's 107 radio stations connecting New York and San Francisco by microwave radio-relay stand on hills and mountains far from towns. Day after day, the apparatus does its duty; no man need be there to watch it. But when trouble threatens, an alarm system developed by Bell Telephone Laboratories alerts a testman in a town perhaps a hundred miles away.

A bell rings. The testman sends a signal which asks what is wrong. A pattern of lights gives the answer —a power interruption, an overheated tube, a blown fuse, a drop in pressure of the dry air which keeps moisture out of the waveguide. At intervals the testman puts the system through its paces to be sure it is on guard.

Sometimes the testman can correct a trouble condition through remote control, or the station may cure itself—for example, by switching in an emergency power supply. Sometimes the trouble can await the next visit of a maintenance man—sometimes he is dispatched at once.

This is one of the newest examples of the way Bell Laboratories adds value to your telephone system by reducing maintenance costs and increasing reliability.

Alarm-receiving bay in town. Lights on a chart report on 42 separate conditions affecting service. Telephone is to communicate with maintenance crews. Eleven alarm centers across the country cover all 107 radio-relay stations. Stations too far off the beaten trail for wire connections signal by very high frequency radio.

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Index To Advertisers

*Aldrich Pump Co. 45
All-American Tool & Mfg. Co. 70
Allegheny Ludlum Steel Corp. 16
Aluminum Co. of America 6, 7, 124
*American Blower Corp. 18
*American Felt Co. 31
Amplex Mfg. Co., Div. of Chrysler Corp. 107
ASME Publications 65, 116, 126
Arkwright Finishing Co. 44
Aurora Pump Co. 69
Automotive & Aircraft Div., American Chain & Cable 127
*Babcock & Wilcox Co. 2nd Cover
*Barco Mfg. Co. 52
Bell Telephone Laboratories 135
Bigelow-Liptak Corp. 26
Birmingham Committee of 100 61
*Blaw-Knox Construction Co., Power Piping Div. 123
Bridgeport Thermostat Div., Robertshaw-Fulton Controls Co. 82
Briggs & Stratton Corp. 50
Brown & Sharpe Mfg. Co. 30
Bruning, Charles, Co. 32
*Buffalo Forge Co. 10
Carborundum Co. 4, 5
Carrier Corp. 2
Chain Belt Co. 14, 15
*Chikuan Co. 21
*Cleaver-Brooks Co. 111
Climax Molybdenum Co. 62
Columbia-Geneva Steel Co. 22, 23
*Combustion Engineering-Superheater (Inc.) 121
Coppus Engineering Corp. 113
Cuno Engineering Corp. 29
*DeLaval Steam Turbine Co. 20
*Denison Engineering Co. 28, 58, 64
Diamond Chain Co. (Inc.) 77
Dow Corning Corp. 42
Dresser Industries (Inc.) *Roots-Connersville Blower Div. 37
Drop Forging Association 51
Eastman Kodak Co. 70
*Elastic Stop Nut Corp. of America 115
*Engineer Co. 80
*Erie City Iron Works 98
Fafnir Bearing Co. 137
Fairbanks, Morse & Co. 19
*Farrel-Birmingham Co. 76
Farval Corp. 118
Fenwal (Inc.) 110
*Flexitallic Gasket Co. 39
*Foote Bros. Gear & Machine Corp. 83
Ford Instrument Co. Div. of Sperry Corp. 103
*Foxboro Co. 62, 78
Fulton Sylphon Div., Robertshaw-Fulton Controls Co. 82

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*General Electric Co. 109
General Radio Co. 114
Graphite Metallising Corp. 63
*Grinnell Co. 11
Hagan Corp. 108, 120
Hathaway Instrument Co. 56
Helicoid Gage Div., American Chain & Cable 47
*Heli-Coil Corp. 59
*Hoffman Combustion Engrg. Co. 8, 9
*Homestead Valve Mfg. Co. 94
Hyatt Bearing Div., General Motors Corp. 104
International Nickel Co. 34
Iron Fireman Mfg. Co. 90
Irving Subway Grating Co. 63
Jenkins Bros. 40
*Johns-Manville 81
Kellogg, M. W., Co. 97
Keuffel & Esser Co. 12, 13
*Kewanee-Ross Corp. 54
*Koppers Co. (Inc.) Fast's Coupling Dept. 3 Precipitator Dept. 101
*Ladish Co. 17
Ledoen Mfg. Co. 64
Linear (Inc.) 84
*Link-Belt Co. 95
Lord Mfg. Co. 72, 73
Lukens Steel Co. 88
Lunkenheimer Co. 89
MB Mfg. Co. 93
Micrometrical Mfg. Co. 55
*National Airoil Burner Co. 64
National Carbon Co., Div. Union Carbide & Carbon Corp. 75
National Power Show 46
New Departure, Div., General Motors Corp. 1
Nicholson, W. H. & Co. 69
Northern Blower Co. 92
Nugent, Wm. W. & Co. 48
Oberdorfer Foundries (Inc.) 125
Ohio Injector Co. 74
O'Neil-Irwin Mfg. Co. 43
*Peerless Pump Div., Food Machinery & Chemical Corp. 123
Permutit Co. 3rd Cover
Philadelphia Gear Works (Inc.) 122
Pipe Fabrication Institute 91
Power Show 46
Powers Regulator Co. 117
*Read Standard Corp. 57
Reliance Gauge Column Co. 53
*Republic Flow Meters Co. 96
Research Corp. 60
Revere Copper & Brass (Inc.) 112
Robertshaw-Fulton Controls Co. 82
Rockford Clutch Div. of Borg-Warner Corp. 127
*Roots-Connersville Blower Corp. 37
*Sarco Co. 126
Smooth-On Mfg. Co. 126
*Spence Engineering Co. 100
Spraying Systems Co. 70
Sturtevant, P. A., Co. 63
*Taylor Forge & Pipe Works 119
Tennessee Coal & Iron Div. 22, 23
*Terry Steam Turbine Co. 105
Thomas Flexible Coupling Co. 66
*Timken Roller Bearing Co. 4th Cover
Trabon Engineering Corp. 138
*Tube Turns (Inc.) 85, 86
U. S. Steel Co. 22, 23
U. S. Steel Export Co. 22, 23
U. S. Steel Supply Div. 22, 23
Vickers (Inc.) Div. of Sperry Corp. 27
*Vogt, Henry, Machine Co. 87
*Voss, J. H. H., Co. 125
Walworth Co. 106
*Westinghouse Electric Corp. 24, 25, 33
*Wickes Boiler Co., Div. of Wickes Corp. 71
Wiegand, Edwin L., Co. 66
Williams Gauge Co. 67
*Wing, L. J., Mfg. Co. 124
Wisconsin Motor Corp. 60
Wolverine Tube Div., Calumet & Hecla Cons. Copper Co. 102
*Yarnall-Waring Co. 35

CONSULTING SERVICE . . . Page 134

Black & Veatch
Ehrco Die Casting Service
Electrical Testing Laboratories
Hathaway, C. M.
Jackson & Moreland
Kendall, George H.
Kuljian Corp.
Mast Development Co.
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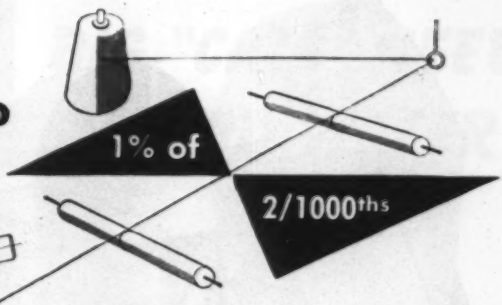

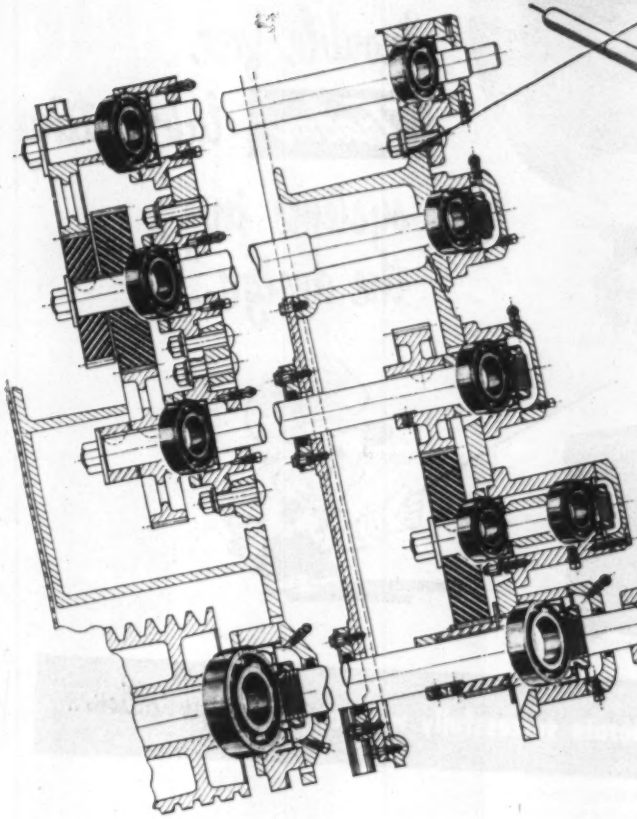

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If you are familiar with machine designing, you'll consider this a "neat" piece of engineering. Such precision is actually achieved on mammoth synthetic thread twisters developed by Whitin Machine Works. The twisters stretch thread to a uniform .002 of an inch diameter and hold that diameter to within a 1% tolerance down a 40 foot line of spindles.

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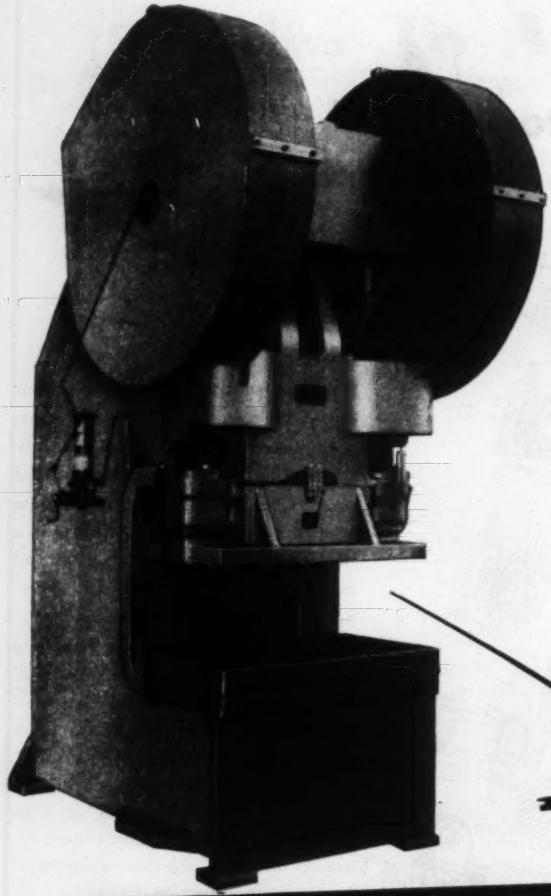

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For the past 21 years industry has benefited through the use of Trabon lubrication by increased production and lower operating and maintenance costs.

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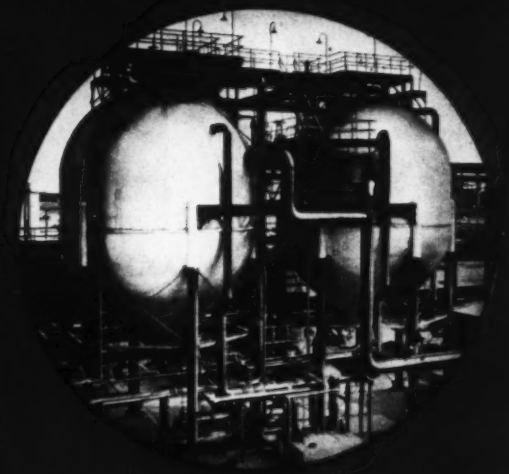

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—and Permutit Equipment brings it, at lower cost, to The Texas Company's new Eagle Point "cat" crackers . . .

The Texas Company, at their Eagle Point Works in Westville, N. J., processes 60,000 barrels of crude per day, in which processing modern fluid catalytic cracking is used. Over-all refinery steam and electric power balance dictated refinery boiler plant operation at 900 psi. Treated water is used on waste heat boilers on the cat cracker. They operate a Permutit two-stage hot lime soda and phosphate water softener to protect their boilers against scale and corrosion. Permutit equipment and its location are illustrated.

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Due to their tapered construction, Timken bearings carry both radial and thrust loads in any combination. They can be adjusted to any desired preload to prevent chatter and provide maximum rigidity.

Timken precision bearings are made specifically for precision spindle applications. Timken "Double Zero" bearings are available with a maximum run-out of only 75 millionths of an inch (.000075").

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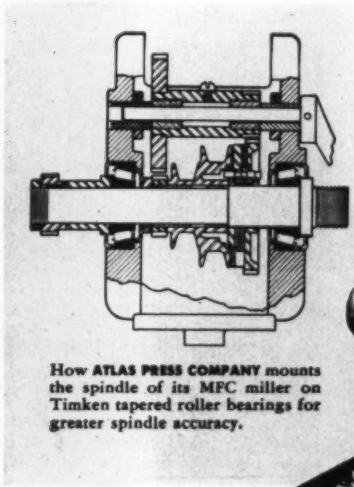
Timken bearings reduce machine tool manufacturing costs too. No special thrust bearings are needed. Assembly and set-up of the bearings are quick and simple.

Get all the advantages only Timken bearings offer you by specifying them for the machine tools you build or buy. Look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



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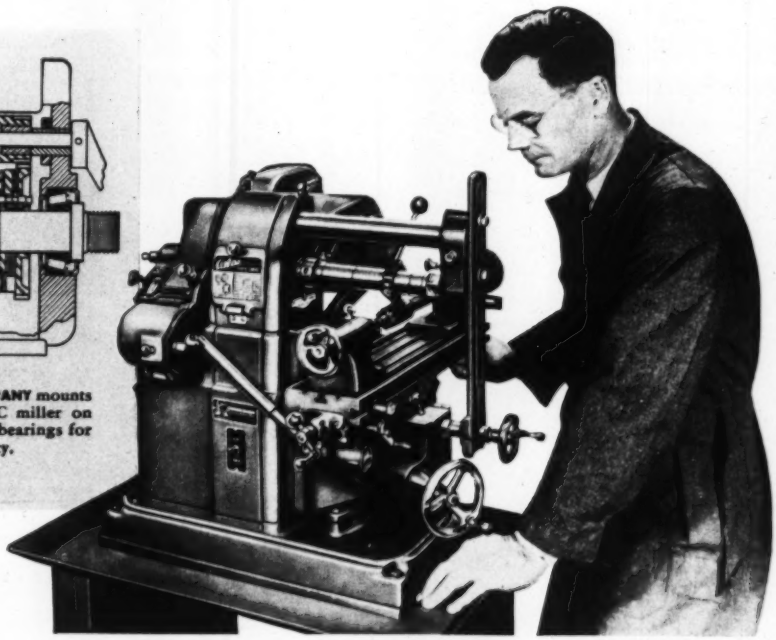

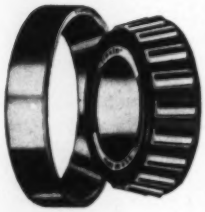

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FINISHED TO CLOSER TOLERANCES

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